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On Being An Exception.

A CONTRIBUTOR to the ELECTRICAL REVIEW recently (August 16th, p. 269) complained that very few electrical engineers practised what they preached in regard to the use of electricity in the home. A correspondent in a subsequent issue implied that their incomes were not such as to enable them to consume their own product, since electricity did not compare favourably in cost with gas. We mention this case as an illustration of the fact that the all-electric house is still the exception, since if electrical engineers themselves are not satisfied that electricity is worth using for heating, cooking, &c., how is it likely that others will adopt it to the exclusion of other methods.

We think our correspondent does not do justice to the large number of undertakings (a number that is steadily increasing) which are now charging competitive prices and giving service quite comparable with that afforded by most gas undertakings; there is every indication, also, that these are feeling their way with legitimate caution towards bigger things. Nevertheless we do not suggest that blame necessarily attaches to individual electrical engineers for their apparent apathy. Other things being approximately equal they should, no doubt, give a decided preference to the commodity which provides their livelihood. We do not believe, however, that they best serve their industry by giving preference to its product in areas where it can be justifiably used only by people of substantial financial position, and where by doing so they help to confirm the authority in its wicked ways and serve as examples to other consumers to pay more than they can afford. Disgruntled consumers generally lay the blame on electricity, and not on the tariff and deter those living in more progressive areas from taking advantage of their opportunities. The latter often state baldly, in agreement with our correspondent, that while they believe electricity to be unexcelled for cooking, &c., they have been told by friends (in other towns) that its cost is prohibitive.

There are many undertakings which, by their regulations and their method of approaching consumers, confirm them in an undesirable habit of mind regarding electricity. We have heard it said by some consumers that they feel themselves to be regarded as criminals by

the undertaking. This, we are sure, is an exaggeration, as the actions of such undertakings imply no more than that would-be cooking and heating consumers are harmless cranks, who must be indulged in their idiosyncracy. The exceptional nature of their requirements is emphasised by exceptional treatment, such as payment for a new service, perhaps even a restriction on the size of installation, and other vexatious special stipulations. In addition, the consumer may have to spend large capital sums on wiring and apparatus at a time when he is meeting the heavy expenses incurred in moving into a new house, which is possibly already piped throughout for gas. Moreover he fears that if he leaves the house he could not sell so exceptional an article as an electric oven to the new-comer.

The average man is gregarious and conservative, and is disposed to follow a fashion. He does not like to be thought odd and looks for some substantial advantage in return for a departure from precedent. Unless he be more persistent than most of us, his final action is to ring up the gas undertaking, whose officials make him feel that by coming to them he is behaving in an orthodox and commonsense way.

The gas industry encountered successfully a far more difficult position than that which awaits the electrical industry in the domestic field. It was necessary to convince the public, in the face of cheap coal, that thermal value for a given sum was not the only criterion of cost; that was a feat which had not been attempted before, and one for which credit should be allowed the gas industry. Electricity finds a public that has long accepted this argument and has only to press home its modern *a fortiori* application. The gas industry has had the wisdom sedulously to foster an atmosphere that gas is the natural and better alternative to coal for heating and cooking. There are some electricity supply undertakings which are obviously imbued with the importance of this psychological aspect, treating the domestic consumer as part of their natural scheme of development and not as an exception. *O, si sic omnes!*

Is the Trade Samples System Worth While?

A correspondent signing himself "Sales Manager" writes to us concerning a trading detail to which we may draw our readers' attention. From time to time, as the result of the circulation of publicity literature and various forms of Press and other advertising, he receives applications from various classes of traders for free samples of, and quotations for, the advertised proprietary electrical accessory. The requests are met, but no acknowledgment returns. Our correspondent holds that he is justified in expecting to receive a reply, whether the recipient is interested in his article or not. If he hears that interest in the accessory is not aroused, he will be able to keep a record of "useless" people and waste no further time and postage upon them. Now it would be interesting to know the views of other manufacturers on this matter, and whether they conduct their business all through along such lines. It may be easy to eliminate names from one's list and never get them back there, just because some member of the staff may at the moment have expressed disinterestedness. A statement that we may quote from very sound literature reminds us of "bread cast upon the waters returning after many days." An expression quoted from a literature that is, shall we say, a little lower than that of the angels, urges the adoption and pursuance of the "follow-up" principle in business promotion. Publicity men who know their business will be only too glad to send samples to inquirers after they have offered to do so, but whether they are justified in expecting them to be returned with effusive gratitude when they are not at the moment wanted, we should like other trade writers to say. Interest may well have been aroused and the sample kept, until the moment when the supposedly rejected product fits exactly into the requirements of the "discourteous" trader, and he may find it timely to give an order for a dozen, a gross, or a dozen gross. We feel that it is very easy to be shortsighted in business, and we recall the oft-repeated advice of British consuls and commissioners abroad to British manufacturers that samples make a great impression upon the minds of potential buyers in Dominion and foreign markets. If we advertise ourselves as ready to send samples of goods, we must not expect to succeed, as a general rule, unless we apply our policy without niggardliness.

The Indian Market.

It is anticipated that during the next few months many British manufacturers will be sending representatives to visit the Indian market, and it is timely to remind our readers of the facilities and assistance that His Majesty's Trade Commissioners desire to render in such cases. The Department of Overseas Trade in London is anxious to provide visitors with letters of introduction to Major Clarke, the Acting Senior Trade Commissioner at Bombay, and to Mr. W. D. Montgomery Clarke, Trade Commissioner at Calcutta, both of whom are in a position to render excellent assistance through their organisations to all who are developing the sale of British goods. Special information will be imparted to inquirers prior to departure, by the Department of Overseas Trade in London. Mr. T. M. Ainscough, H.M. Senior Trade Commissioner for India, is now in this country and can be interviewed here from September 23rd.

Outdoor Sub-stations.

The tendency to revert from the full outdoor distribution sub-station to the semi-outdoor type, in which the transformers only are left in the open, is referred to by Mr. G. Scott Ram in his section of the annual report for 1928 of H.M. Chief Inspector of Factories and Workshops, which we abstracted in our issue of August 16th. One instance of this is found in the intention of a large undertaking in the Midlands to house all its switchgear within substantial buildings, as a result of considerable trouble experienced last winter. The general conclusion is that, when oil-filled switchgear is used, it should be installed in a permanent structure. In many cases elsewhere kiosk sub-stations, consisting of sheet-metal enclosures for transformers and switchgear, operated from without, are being superseded by brick buildings for the switchgear, which allow space for operation inside, the transformers being placed in the open.

The design of many outdoor sub-stations leaves much to be desired, and in some cases precautions which are taken as a matter of course in indoor sub-stations are omitted. Their unsatisfactory features appear to be due to two causes, (1) the desire for economy, and (2) the lack of practical operating experience on the part of designers. However desirable it may be to secure an economical construction—and the nature of the load served by outdoor sub-stations often makes a low capital cost imperative—this should not be obtained by disregarding the risk of danger to the attendant, who, moreover, may have to carry out work in semi-darkness or in bad weather, which increase the normal risk.

Next Week's Functions.

The coming week will see the start of several important functions referred to in this issue under "Forthcoming Events." On Monday the Association of Public Lighting Engineers will hold its annual conference at Bournemouth. Four papers serve as a reminder that street lighting was one of the earliest commercial applications of electricity.

The Shipping and Machinery Exhibition will open at Olympia on Tuesday. Some 60 exhibits, out of a total of about 300, will be of direct electrical interest. Most of the new electrical items consist of instruments, *e.g.*, thermometers, pyrometers, and ship and boiler controls.

On the same day the Iron and Steel Institute begins its autumn meeting at the North-East Coast Exhibition, Newcastle, and on the day following the Municipal Tramways and Transport Association its annual conference at Great Yarmouth. The Institute of Metals is also holding its autumn meeting at Dusseldorf.

Testing High-Capacity Oil Switches.

Some Details of a New French Installation.

By C. J. WEBB, A.I.A.E.

THE rapid development which has taken place in recent years in electric power generation and distribution has necessitated the installation of larger generating sets and the inter-connection of different stations by high-voltage transmission lines.

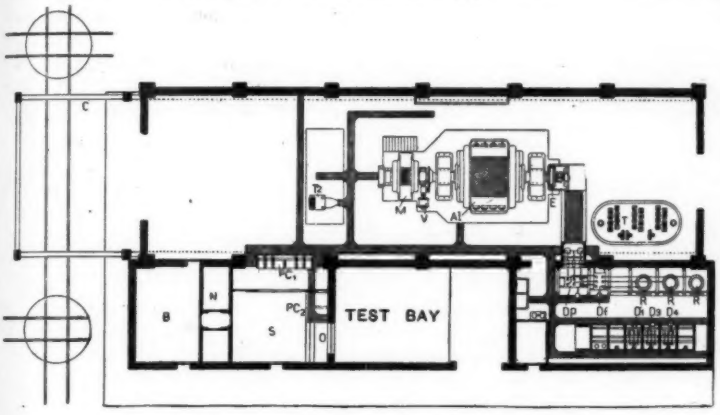


Fig. 1.—Plan of Oil-Switch Testing Laboratory.

This tendency of modern practice has brought with it many serious problems, not the least of which is that of providing switches capable of interrupting short-circuit currents of considerable magnitude with the utmost promptitude.

Accordingly, during recent years oil-immersed switches have undergone considerable development. Much experimental work, attended with fruitful results, has been carried out in this connection in England by manufacturers and the Electrical Research Association, by the Brown-Boveri Co. in Switzerland, the Westinghouse Electric and Manufacturing Co. in the United States, and also in Germany. Hitherto, however, France has lagged behind in oil-switch investigation, manufacturers of such equipment having been dependent on information obtained from other countries. This lacuna has, however, recently been filled by the completion at Villeurbanne, Lyons, of a special oil-switch testing installation by the Société des Ateliers de Constructions Electriques de Delle, which it is the purpose of the present article briefly to describe.

Fig 1 is a plan of the station, which is located near the company's offices and works, so that the designing staff and heads of the actual constructional departments will be able to keep in close touch with the work done in the experimental building. The installation comprises a Schneider three-phase alternator A1, with a continuous capacity of 50,000 kVA, 50-periods, running at 1,500 r.p.m., and designed to give 6,000 volts a normal output of 4,800 A; at the end of its shaft is a 200-V, 1,000-A exciter E. The generator is driven by a three-phase asynchronous motor M of 1,350 h.p., fed direct at 10,000 V, it being, however, capable of developing 2,700 h.p. for ten minutes. It is fitted with a starting rheostat embodying naturally-cooled metallic resistances, and an auxiliary 210-V 30-h.p. starting motor V is also provided.

Although, as regards weight of iron and copper and also dimensions, the generator corresponds with a normal machine of equivalent size, its insulation is such that it can withstand excess excitation of 50 per cent.; in other words, considerable power can be generated at 9,000 V, the excess excitation allowing of a similar proportionate increase in the power available for short-circuiting, but keeping well within overheating limits. The reaction due to the machine losses is 0.195 ohm per phase, equal to a short-circuit voltage of 27 per cent.; the reactance may seem high, but it was considered preferable to sacrifice a little power in the interests of safety and strength.

The generator is star wound, with a neutral point that is readily accessible and can be connected to earth; in addition, each phase is divided into two parts, which may be connected either in series or parallel. Special provision had to be made for limiting the possibility of damage to the machine following short-circuiting. The rotor weighs 40 tons and the stator 150 tons. In explanation of the manner in which it has been possible to obtain from a generator of a normal capacity of 50,000 kVA a short-circuit capacity equal to that of a 200,000-kVA power station, the Delle Co. points out that it is partly due to the excess excitation of the generator. With a 50 per cent. increase in excitation the machine's output is increased 150 per cent., and there is also a gain by the weakening of the field by actuating the switch earlier than in actual station operation.

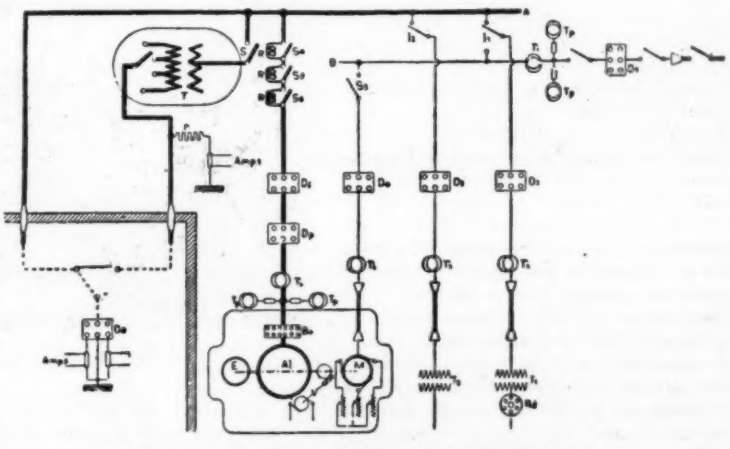


Fig. 2.—Diagram of Electrical Connections.

In order to permit tests to be conducted at various voltages, the installation comprises a transformer T fed by primary current from the generator and delivering from the secondaries, by means of special couplings, power at 5,500, 26,875, 31,000, 53,750, 62,000 and

107,500 V. This range is obtained by dividing the winding into four parts, all of which may be connected in series, or in two groups of two in series, or all in parallel; moreover, the different phases can be branched in star or delta form. The transformer has been built by the Société Savoisienne de Constructions Electriques of Aix-les-Bains, and relies entirely on oil cooling.

For the supply of the necessary power the Société Générale de Force et Lumière, of Lyons, has erected a special 100,000-V transmission line 1¼ miles in length.

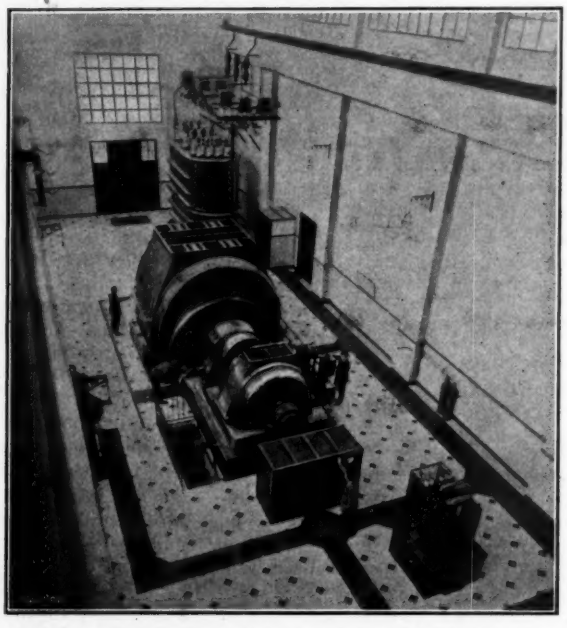


Fig. 3.—Motor-generator and Step-up Transformer.

The motor-generator and voltage-raising transformer T are located in a room 124 ft. in length by 36 ft. in width. Rails for an overhead electric travelling crane of 50 tons capacity are mounted towards the top of the side walls and extend through a wide opening in one of the walls, so that the crane can be taken into the open air to pick up any material from the works intended for the testing department. The power-receiving and control department and the actual oil-switch testing yard form annexes to the building. A diagram of the connections is reproduced in fig. 2; special attention has been devoted to providing a simple arrangement that shall be subject to the minimum possible derangement. The lay-out comprises two main sections:—

(1) The 10,000-V section, which comprises a main set of bus-bars B with three circuit breakers D, T2, and D4 controlling the incoming power, the leads to the different machines and the feed to the auxiliary circuits; this part of the installation calls for no special description.

(2) The 9,000-V section which consists of high-capacity circuits comprising bus-bars A connecting the alternator to the apparatus under test directly, or through the high-voltage transformer T, or the heavy-current transformer T2.

In all cases the current from the alternator passes *via* the switch D*p*, which serves as a protector, being intended for quickly cutting off the current in case of the breakdown of the apparatus under test, its circuit-breaking capacity being one million kVA. The current then passes through a second switch D*f*, designed to set up short-circuits, and embodying auxiliary contacts, by means of which it is possible to regulate the interval of time, from zero upwards, between the creation of the short-circuit and the initial action of the switch. Following switch D*f* are the reactance coils R, which serve to vary the intensity of the rupturing current imposed on the switch under test. When it is desired to use the maximum current intensity, the coils can be short-circuited, and they are also so arranged that 71, 50, 38, 28, 20, 16, or 12 per cent. of the current at any one of the voltages available can be passed. Finally, the power passes either directly to the apparatus under test, or to the transformers T or T2, and later to T1. A third system of bars gives connection between the h.p. terminals of the transformer and the test room.

The method of forming the 9,000-V circuit was determined by the necessity for it to withstand considerable strain, notably so in the case of the alternator windings being coupled in parallel (4,500 V), when the current may reach 136,000 A, which would cause considerable repulsion between the conducting bars. To overcome this strain, insulated supports were at first used every 20 in., but they were found to be insufficient, so that additional bakelite supports had to be fitted; the bars themselves are made of heavy-section copper tubing.

In the control room is a special cabin containing a battery to supply current for the operation of the controls, the emergency pumps, emergency lighting, &c.

The test yard proper has been laid out with the object of providing maximum safety for the staff and the adjacent building. The walls are of ferro-concrete from 20 to 24 in. thick, and a light roof of fibro-cement protects the apparatus under test from rain, this material having the advantage that even in the event of an explosion it would break into small harmless pieces. Armoured cables are used between the apparatus under test and the measuring and control rooms. The latter form the second annex of the building, and are so laid out that everything can be controlled by a limited staff, usually consisting of an engineering official and a workman. The test observation, measuring, and recording room (fig. 4) is combined with the central control place PC1 (fig. 1) in an adjoining room. In the observation room is a board PC2 on which are mounted two oscillographs and other instruments for recording from a distance the behaviour of the apparatus under test; also commutators for controlling the oil switch under test and a circuit breaker D1 for closing the short-circuit.

The method of testing a high-voltage oil switch is briefly as follows:—The generator set is started by means of the auxiliary gear and then driven at 1,500 r.p.m. by the motor; the exciter is then switched in. If the test is to be made at a different voltage to that of the generator, the step-up transformer is put into circuit, these operations occupying altogether about ten minutes. By means of remote control the motor is then switched off and a short-circuit created by closing the generator switch, which action causes the oil switch under test to function and rupture the circuit. The power available is such that oil switches of practically the largest sizes

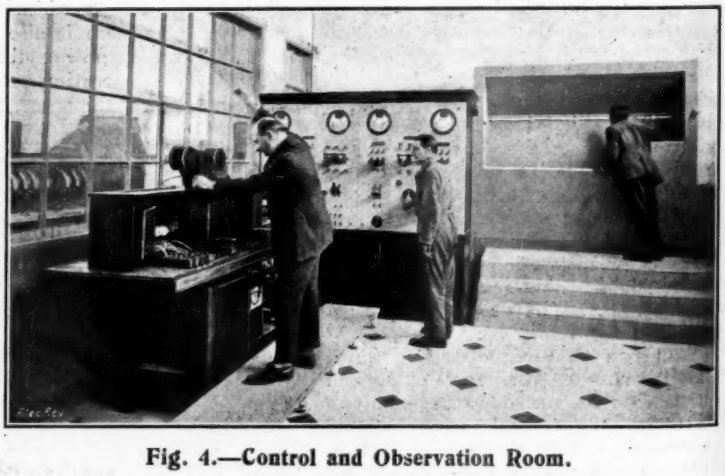


Fig. 4.—Control and Observation Room.

in modern use can be tested. During tests the observer stands on a small platform (figs. 1 and 4) o in room s and peers through a narrow slot in an 8-mm. steel plate let into the ferro-concrete wall.

Finally, referring to fig. 1, N is a dark room for developing the oscillograms, and B a retiring room for the engineers. From the central control room (fig. 4) PCl, in which is a six-panel desk, it is possible to control every point of the installation with the exception of the actual starting operations.

The equipment of the station also includes a step-down transfromer T2 which can be connected to the generator and can give at the secondary terminals an effective output of 100,000 A at 100 V for twenty minutes, or 250,000 A at 90 V for three seconds, the maximums being 260,000 A and 640,000 A. The purpose of this transformer is to enable electrodynamic phenomena to be observed, particularly as regards their effect on contacts, sectionisers, and current-measuring transformers. Space has been provided in the station for the installation at a later date of a d.c. generator, designed to generate at 750, 1,500 and 3,000 V. This machine is to be used for testing electric traction equipment.

"Laying-on" Domestic Wireless.

A criticism of the service in the average household, and some notes on the author's installation.

By G. E. MOORE, A.M.I.E.E.

LET me introduce myself as one of that large band of listeners which dutifully and thankfully pays the insignificant licence fee that allows it to receive the programme of the nearest B.B.C. station, and wishes to do so with the minimum of bother whenever an interesting item is broadcast. In effect, the service required is very similar to that of a public utility like electrical energy or water: the broadcast supply on the local ether to be "on tap," available at will and instantly. Obviously, I am no radio "fan" and, candidly, I consider that few "ether searchers" are really unselfish enough (and skilful enough, too) to give their households radio supply from any station that is dependable and musically, or otherwise, satisfactory.

A household wireless installation should have several necessary qualities. Complete and unfailing reliability is very important, and one must add simplicity and foolproofness, and, indeed, safety. A set tuned to a neighbouring transmitter, which delivers a B.B.C. programme merely by the act of turning on a switch or plugging-in, meets the case. At the same time this arrangement makes it possible, not only to obtain volume economically, but also to ensure purity of reception and minimum interference (I refer now and throughout to the average present-day listener, neither enthusiast nor Crœsus).

The simplest set is that consisting of a small aerial, tuning coil, crystal, and headphones; there is a great number of persons (many of them electrical people perfectly able to afford a multi-valve set and a 6-ft. moving-coil speaker!) who still favour this "antiquated" arrangement. No doubt the pure reception is one reason. For my part, I think that there is a certain fascination in headphone use, whether for signals from a neighbouring station, or, more particularly, from a transmitter hundreds of miles away. Headphones are not doomed yet.

Although the loud-speaker has not ousted head-phones, it inevitably is the reproducer in general use. The average loud-speaker, though portable, usually remains in one room, and not always in a position that is acoustically, or otherwise, satisfactory. Such limitation to its use seems absurd; it should be possible to listen comfortably anywhere within the domestic area. No doubt a wealthy householder could install a speaker in each room (has it ever been done?), but Mr. Everyman must be content with one. Room circuits are somewhat favoured in more or less improvised form, and remote control dabbled with here and there. Curiously enough, the amateur wireless constructor rarely tackles the comparatively simple job of making his installation really convenient. The speaker or head-phone remain tied to the set, which is naturally only semi-mobile in most cases: for all practical purposes the whole outfit (apart from 'phones or speaker) could be compactly and unobtrusively installed; permanent wiring could be run to convenient listening points, and simple means adopted by which anyone could make the "radio supply" available where desired.

I cannot forbear mentioning the crop of more or less makeshift aerials which has sprung up all over the country, many of them erected by irrepressible home-constructors. A straight and sturdy pole supporting a really high aerial has its uses, but there is a pathetic belief in the magic properties of *any* pole, no matter of what kind, while attic or loft aerials, or chimney-to-chimney ones, apparently are taboo; yet listeners (or some of them) have æsthetic feelings of a sort. Doubtless they would fight to the last backyard if an electricity supply authority contemplated running an overhead power line in the district. They may argue that an outdoor aerial is worth an additional valve; granting this, it would appear that appearance is not worth the cost of a valve.

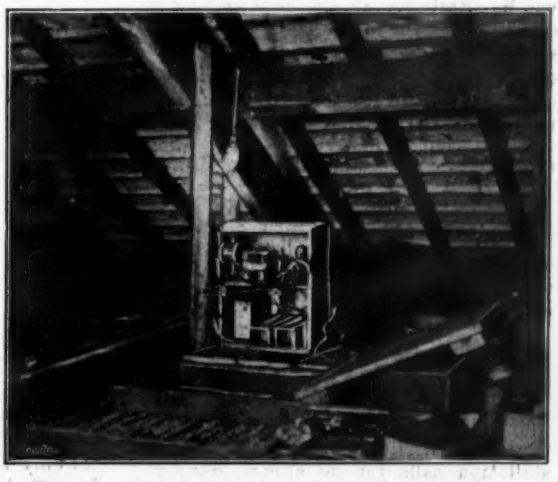


Fig. 1.—Novel Situation of Wireless Receiver.

I consider that a carefully-erected indoor aerial, with its useful advantages of cheapness, accessibility, dry insulators, lack of corrosion, and protection from lightning and static discharges, undoubtedly scores over a little gimcrack aerial outside one's house. In any case the average householder's requirements are such that a completely indoor radio installation will meet his general need, and at little more initial cost than one using an outdoor aerial.

It is, of course, a popular and easy matter to throw mud—but few critics are constructive enough to make even a mud pie. I have discharged some heretical views and comments anent wireless installation. What, then, have I done to live up to my ideas? This:—

Reception.—In the loft of my bungalow I have placed not only an aerial, but also the receiving set (fig. 1).

The aerial consists of several 26-ft. lengths of the usual wire, several feet apart. The set is located at the side of the aerial and near its end, and the earth connection is immediately underneath—a copper water-pipe to the lavatory. Conditions are most unpromising, for while the set is about 12 ft. from the ground the average height of the aerial is only 4 ft. above the set; there are also earthed conduits containing a.c. lighting cables immediately underneath the aerial.

The set itself is not novel: a simple tightly-coupled arrangement with a tuning condenser, permanent-type carborundum detector, with potentiometer and cell ("stabilising detector unit"), and a two-valve amplifier (detector and small power valves with high-quality inter-valve transformer); it is *not* possible to be earthed whilst listening. Fig. 2 gives a diagrammatic impression of the apparatus; the set is in two "storeys," each component has its own insulated support, and terminals are on strip ebonite.

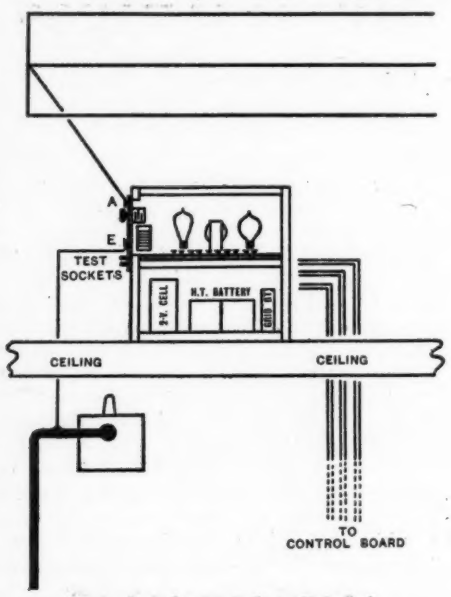


Fig. 2.—Arrangement of Set.

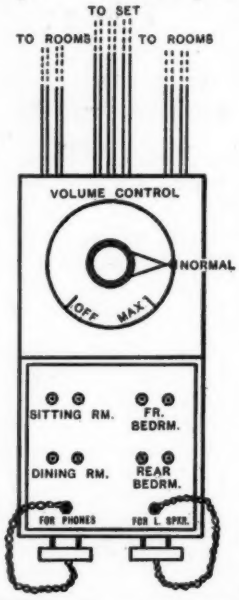


Fig. 3.—Remote-control Panel.

Signal strength of crystal output (the local 1½-kW station is 4 miles away) is ample. Filament supply is from a large-capacity cell giving 80-100 hr. per charge. Conditions vary from tropical heat in summer to below zero in winter. The anode battery (132 V), though often covered with moisture, seems (like the remainder of the set) to be unaffected by the environment; the present battery has lasted 12 months and is still undiminished. Sound connections were vital throughout, and the chief original trouble was in a weak potentiometer slider; the first "fixed" carborundum detector proved to be variable, but the present one is faultless. The set is visited very infrequently.

Control.—Such control as is required relates only to the use of the head-phones or loud-speaker, and to switching-on of the volume control of the amplifier. Almost underneath the set, and in a fairly central position in the house, is a neat and unobtrusive control-board (fig. 3). The rheostat is, of course, in the filament supply circuit, and "off" and "normal volume" positions are marked (h.t. "switching" in this way is, I believe, suspect, but I have no trouble to report).

Double-sockets for four rooms are provided, and flexible 2-pin plug-connectors allow either crystal or amplifier output to be made available in any room. Plug-sockets are provided under the window-ledges of day rooms and adjacent to the beds in bedrooms; the wiring from the set is of good-quality twin bell-wire and almost unseen. The only "snag" lay in bunching all the control-board wires together, and the crystal supply wires had to be brought down by another route to prevent howling. (There is actually another break in the filament supply circuit; a pendant switch in one bedroom makes it possible for a bedridden person to switch-on the speaker from that position, if it is already plugged-through to amplifier, of course).

Listening.—I must confess to a predilection for head-phones and a crystal set (hence their inclusion) with their unfailing advantages of purity, consistency, and reliability. The speaker is of a plaque type, and I have so modified the table form of support that it can rest on a flat surface, or hang from a picture-rail; the latter is its usual place, the chief point in its favour being unobtrusiveness. 'Phones and speaker have their own plugs, of course, and both can be in use at the same time in different rooms. As a rule the speaker is plugged-through to the dining-room, and straightway functions when required. Near the control board hangs a long length of twin wire with plug-and-socket ends; with this accessory the speaker can, for example, be used in the garden and connected to the nearest room *via* the window.

Conclusion.—In this way I fitted up a domestic radio installation which has given every satisfaction in respect of complete unobtrusiveness, simplicity of control, availability in any room or the garden, practical absence of maintenance, and thorough reliability. The era of battery supply is passing, but with mains-drive my set will require less maintenance than ever.

It is upon such lines that the house wireless installation should be planned. The vast number of amateur-made sets at present in use cannot be expected to provide ultimate satisfaction in respect of either reproduction or real service. The undoubted superiority of expertly-manufactured apparatus, coupled with rising quality, growing complexity, and falling prices, must in time surely damp the ardour of most home-constructors and their now sophisticated supporters. The average householder will require an efficient and convenient radio supply in the same way that he now looks for his electricity and other household needs. Attention will then inevitably be directed to the actual service and convenience of the apparatus.

Already, here and there, house builders are providing room circuits and even the aerials for radio sets. It is no stretch of imagination to picture the actual provision with a new house of a complete wireless installation.* Institutions and hospitals are large-scale examples of such equipment. It seems inevitable that for this service batteries are doomed, and in future the increasingly varied calls upon local electricity supply networks must surely include a general demand for radio-apparatus energy. Electricity supply authorities are inclined to view such requirements as on a par with bell transformers and neon lamps.

We are faced with we know not what novel developments and combinations, undoubtedly electrical in character. Actual reproduction in their entirety of distant scenes and happenings may not be remote. Present tendencies in the shape of instruments combining radio receivers with electrically-driven gramophones having electrical pick-ups, and also remarkable all-in portable sets, have their special significance; the latter, indeed, are a rival to such an installation as I have described. Future electrical utilities in the domestic sphere must affect architectural designs, and the modern tug-of-war of the homing, or individualist, tendency *versus* the herd-instinct (each stimulated by scientific luxuries) will have unsuspected implications.

It is all a dark and fascinating realm of speculation, into which one ventures uncertainly; but by the light of to-day one can penetrate a little way.

* We have heard of such installations, even the electric lamp bulbs and shades being provided.—EDS. ELEC. REVIEW.

"Daylight" Lighting.

The Raison d'Etre of Daylight Blue Lamps.

By FLITSON JAY.

THE term daylight may be misleading, unless it is realised that the colour value of natural daylight is seldom constant for any length of time. It differs widely, both in character and intensity, according to the time of day, the season, climatic variations, and such modifying factors as reflection from buildings, walls, and other surroundings. To imitate such an inconstant light is obviously impracticable, but while the ordinary gasfilled lamp is ideal for general illuminating purposes, it emits a larger proportion of red and orange rays than is present in natural daylight. For certain occupations this is confusing to the eyes. It would seem to create something akin to an invisible fog or mist which, although it cannot be seen by the eye, has the effect of rendering articles less distinct than they would appear under conditions of natural daylight. The blue glass of " daylight-blue " lamps absorbs some of these excessive red and orange rays, and so filters the light from the lamps that it more closely approximates to natural daylight and is therefore more perfectly suited to those manufacturing processes which require extreme accuracy and colour discrimination.

There are many purposes for which " daylight-blue " lamps are particularly suitable. In cigarette factories, for example, they are used for the inspection of different grades of tobacco, while in certain paper-making establishments they enable blemishes to be detected and remedied during the actual manufacture of the paper. They also enable the grading of various commodities to be carried out as truthfully under artificial light as under actual daylight. Such diverse substances as flour, cement, tea, cocoa, chocolate, mustard, tobacco, coal, and steel may be graded by the light of these lamps with unfailing accuracy. For sorting they provide the ideal form of light and are unexcelled for classifying pearls, seeds, corn, jute, skins, hides, furs, ferrous and non-ferrous metals, and other material and articles of everyday use. In builders' stores and cabinet-making and wood-working establishments they are invaluable aids in the selection of plywoods, timber, and veneers, and also for colouring and graining. Likewise, the reconstruction and suitable decoration of old furniture, for the manufacture of " antique " furniture and fittings; for paint and colour mixing; for colour matching of wall-papers, dyed fabrics, and tapestries. They are useful in laundries for the detection of faded materials and stains, and for marks in fabrics and linens. For weaving, mat making, and a thousand and one textile manufacturing operations they provide an approximation of actual daylight that will permit of every operation being carried out as speedily and with as much precision as during the hours of natural daylight. Spot and plate welding, brazing, plating, and polishing operations are more accurately carried out with the light of " daylight-blue " lamps than under any other form of artificial illuminant.

In aircraft factories the assembly of the many delicate parts that go to make up the wings, ribs, and rudders, the tensioning of the various turnbuckles, yoke ends, shackles, ferrules, taping, spraying, and doping operations need the truest and most accurate form of light. Inspection of parts, and the detection of flaws in wood, metal, tape, or linen demand the use of light that will give the truest visionary acuity. Similarly, the taking of fine measurements with freedom from eyestrain and fatigue demands the best possible light. Examples may be cited where incorrect readings have led to incorrect drawings, and where also the same incorrect readings of slide rules, calliper gauges, micrometers, protractors and other fine-reading instruments have caused wrong quantities to be taken out, wrong jigs to be made, and a huge amount of valuable work to be relegated to the scrap heap.

There are other fields where the use of " daylight-blue " lamps provide that welcome substitute for daylight. In many large stores, correct colour matching can only be carried out under artificial lighting conditions that possess an approximation to actual daylight. Silks, ribbons, tapestries, millinery, and hose cannot be matched under bad daylight conditions or under artificial lighting, unless such lighting possesses an actual purity approximating to daylight.

It is not sufficient, however, that natural lighting should be of pure intensity, but it must be constant and unvarying. Those whose natural light is obstructed by the swaying of trees outside factory windows, for instance, cannot perform delicate operations with any degree of speed or precision; neither can this be done in dull or overcast weather without substituted light of an approximately natural order. On such occasions it is imperative that varying and inconstant daylight shall be reinforced by a suitable form of illuminant, and we know of no better way of rectifying such conditions than by switching on " daylight-blue " lamps, since their illumination is constant and unvarying.

Disposition and spacing of units is important if a system of direct overhead artificial lighting is installed, but if " daylight-blue " lamps are employed for local lighting where required, it will be found that they will reinforce either artificial or deficient natural daylight with marked effect, and render great assistance in the carrying out of delicate operations. It should be borne in mind, however, that in order to obtain this desired correction of the emitted light, some absorption of the light rays necessarily takes place in the blue lamp bulb. It should, therefore, be remembered that when substituting " daylight-blue " lamps for clear ones the wattages should be approximately doubled. The light which is lost by this absorption is more than compensated for by the improved character of the illumination and the increased ease and speed with which operations can be performed.

The substitution of daylight-blue lamps in place of ordinary clear lamps possesses another very distinct advantage, apart altogether from giving increased acuity of vision. By their use harsh shadows and distortion are obviated, and reflections from the bright parts of machinery are softened to such an extent that every moving part and every action of the machines incidental to specific operations is under the direct observation of the operative.

The cost of a few extra watts consumption is therefore of such small moment in these days of substantial rebates for increased consumption that an increase of, say, 100 per cent. in current consumption would result in little actual cost, and this extra cost would be more than balanced by decreased spoilage of work and increased output, owing to the visionary accuracy of the operators being so materially increased.

An interesting " artificial daylight " installation is that at Imperial Chemical House, the new headquarters of Imperial Chemical Industries, Ltd., at Millbank, London. Several methods of filtering were tried experimentally, and pale-blue " Osram " lamps used behind uncoloured glass screens were finally adopted. Regarding the illumination provided, a scale of four foot-candles at the working plane was decided upon, and this is obtained with one 150-W gasfilled lamp in each standard unit. This gives a utilisation of about 25 per cent.

Alternator Protection.

Explanatory notes on the several principles involved in the provision of electrical protection for machines under fault conditions.

By ARTHUR A. F. GILES.

THE increase in the capacity of electricity generating stations during the past few years has brought about the development of numerous protective systems designed to safeguard electrical gear from the abnormal conditions arising from faults.

The chief functions of protective gear are to (*a*) prevent damage to the protected apparatus; (*b*) minimise the area shut down; and (*c*) disconnect the faulty section, with a minimum of disturbance to the remainder of the supply system.

The fundamental qualities required of any protective system are: (1) Sensitivity, so that the faulty section may be isolated in the initial stages of a fault; (2) stability, *i.e.*, freedom from inadvertent tripping; (3) reliability, *i.e.*, freedom from faults developing in the protective gear itself; and (4) discrimination, so that the protection afforded is confined to the zone it is intended to protect.

Four conditions are likely to arise that require adequate protection: (i) Insulation faults in alternator windings, between phases, or between phase and earth; (ii) failure of field excitation; (iii) failure of prime mover, stripping of turbine blades, &c.; and (iv) overloads and short-circuits.

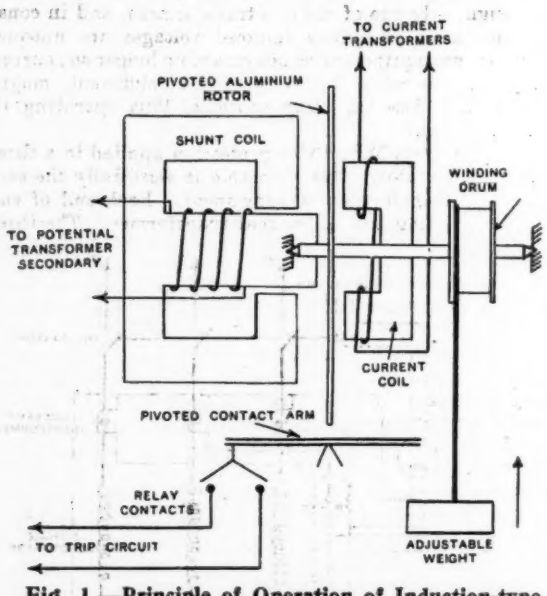


Fig. 1.—Principle of Operation of Induction-type Reverse Power Relay.

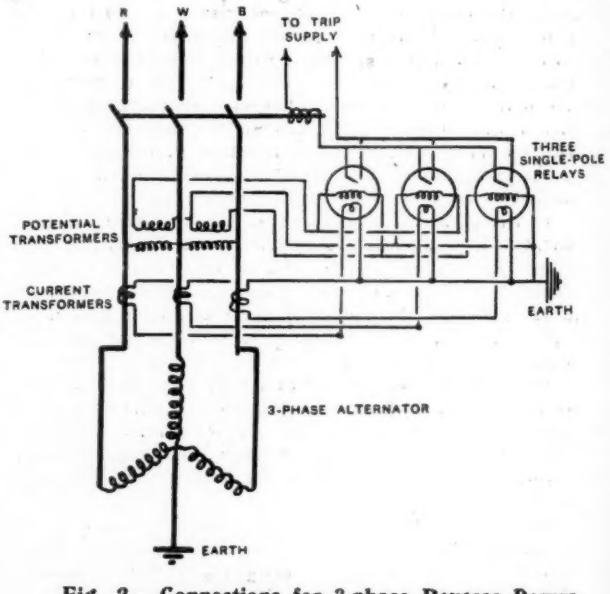


Fig. 2.—Connections for 3-phase Reverse Power Protection.

Overload Protection.

Overload protection covers most of the conditions likely to arise, but is defective when banks of generators are working in parallel, as is usually the case in modern practice. On the occurrence of an overload, the generator with the heaviest load will trip out first, throwing its burden on to the remaining generators, which will trip out in turn. With simple overload protection it will at once be apparent that no discrimination exists between a fault developing on the generators and a fault on a feeder, perhaps miles away from the generating station concerned, especially as some main feeders may have a current capacity nearly equal to that of the generators supplying them.

For the above reasons most supply undertakings have abandoned the use of ordinary overload protection for the alternators, and confined it to the supply networks. It is therefore not proposed to deal further with overload protection as applied to alternators.

Reversed-power Protection.

It is usually deemed advisable to provide some form of reversed-power-protection, which, as its name implies, is intended to protect against any reversal of power that may occur through the failure of the prime mover, causing the alternator to be motored by the remainder of the machines on the bus bars, or through the failure of the alternator field excitation. Reversed-power protection will also afford some protection against insulation faults, when they have reached a considerable magnitude.

The relays used are usually of the induction wattmeter type, and, for those readers who are not familiar with this type of instrument, a brief description of the principles involved in this form of relay may not be out of place. Referring to fig. 1, an aluminium disk is pivoted between the poles of two electromagnets with laminated cores. The shunt electromagnet is wound with many turns of fine wire, and its iron circuit is practically closed, thus giving it an extremely high inductance. This magnet is excited from the potential transformer secondaries of the circuit to be protected. The series electromagnet is excited by the current flowing in the protective current transformer secondaries, and consists of an iron core with a relatively large air gap, wound with a few turns of heavy-gauge wire. The series magnet is consequently of low inductance, when compared with the shunt circuit. There is therefore a considerable phase displacement between the magnetic fluxes threading the two coils, and they may be brought into quadrature by fitting a short-circuited metal band of suitable section around the shunt coil. The fluxes, being in quadrature, virtually form a two-phase rotating field.

The shunt-coil leakage flux and the series-coil main flux, passing through the aluminium disk, will generate eddy currents therein. The magnetic field associated with the eddy currents will then react on the fields pro-

ducing them and exert a driving torque on the rotor (as the disk and staff may be termed) which will rotate, if free to do so. This resulting torque on the rotor will be proportional to the watts passing through the instrument. In order to render the speed of rotation proportional to the torque and watts, the rotor is caused to rotate between the poles of a permanent magnet. The

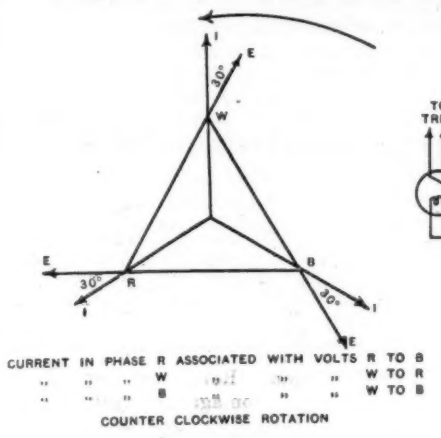


Fig. 3.—Phase Relations at Unity Power Factor.

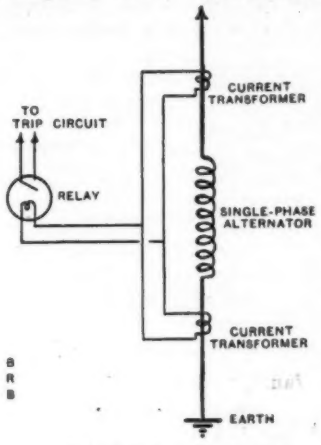


Fig. 4.—Merz-Price Protection Applied to Single-phase Alternator.

rotor staff is shown fitted with a small winding drum, from which is suspended an adjustable weight, by means of a cord. Raising this weight beyond a certain point closes the relay contacts and energises the trip coils, or it may short-circuit the no-volt coils on the oil switch. A ratchet-and-pawl or similar device is fitted to prevent the rotor running whilst the power is outgoing from the alternator. On a reversal of power occurring, the driving torque of the relay is reversed, and if of sufficient magnitude to overcome the retarding torque due to the suspended weight, the rotor will commence to wind up the weight.

If the reversed power is maintained sufficiently the weight will close the relay contacts. The starting current of the relay is adjusted by means of the weight, and the length of time taken to close the relay contacts is governed by the strength of the permanent braking magnet, the distance the weight has to be lifted, and the value of the reverse current.

The ultimate result is that the time taken for the relay to operate, once it is set in motion, is approximately inversely proportional to the value of the reverse current. Since there may be small transient reversals of power under quite safe conditions, these limits to operation become necessary.

Fig. 2 is a diagram of connections for reverse-power protection of a polyphase alternator. A relay is connected in each phase, the voltage coils being supplied from the potential transformer shown, and the current coils supplied from their respective current transformers. It should be noted that on a reversal of power and current flowing into the alternator, the output from the current transformers will be reversed, whilst the potential transformer is unaffected. Fig. 3 shows the phase relations resulting from the connections shown in fig. 2. It will be seen that the current in phase R is associated with the voltage R to B; the current in phase W with voltage W to R; and the current in phase B with voltage W to B. Under these conditions, when the alternator is working at unity power factor, there is a phase displacement of 30 degrees in each of the relay circuits. In consequence, the relays are more sensitive at a lagging power factor; they will, however, operate on a very low leading power factor, but such conditions are unlikely to arise, unless the field excitation of the machine fails.

Protection Against Insulation Faults.

In order to safeguard against faults to earth and between phases circulating-current protection may be used. This system is covered by the Merz-Price patents and gives protection against insulation faults in the alternator, either between phases or phase and earth, but gives no protection against faults between turns of the same phase. The arrangement is not affected by faults external to the alternator, and may include overload protection, if desired.

Fig. 4 shows the principle of Merz-Price protection applied to a single-phase generator. It will be seen that current transformers are installed in each line, having their secondary windings connected in series, so that the secondary currents may circulate. With equal currents flowing in both transformers, it would be possible to find two points at equal potential in the pilot wires connecting the transformers in series, and from two such points tappings are taken to an operating relay.

The action depends on the fundamental fact that under normal conditions the current flowing from one end of a generator winding must balance with that returning at the other end (at any instant). This being so, the current transformers carry equal currents, and the relay tappings remain at equal potential, no current flowing in the relay circuit.

In the event of a fault developing to earth in the insulation of the alternator, or any gear between the alternator and the protective current transformers, current will flow to earth and back through the earthed end of the winding. It will be seen that this earth current flows through only one of the two transformers, and in consequence their secondary induced voltages are unequal. The former equipotential points are no longer so; current flows in the relay circuit and, if of sufficient magnitude, will close the relay contacts, thus operating the tripping gear.

Fig. 5 shows Merz-Price protection applied to a three-phase alternator. The principle is essentially the same as in the single-phase arrangement. Each end of each phase winding has its current transformer. The three-

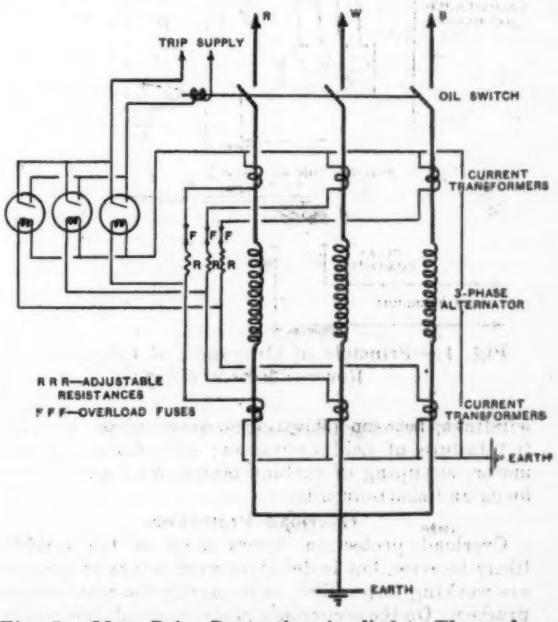


Fig. 5.—Merz-Price Protection Applied to Three-phase Alternator.

phase alternator is shown connected in star, as also are the current-transformer secondary windings and the relay coils. In the event of an earth fault developing in one of the windings, the earth current will be carried by the current transformer in the earthed neutral, and the relay will operate as in the single-phase case. If a fault should occur between two of the phase windings, the fault current would circulate through the current trans-

formers in the neutral ends of the phases concerned and, upsetting the equipotential points, cause the relay to operate.

It will be seen that a fault occurring beyond the protective current transformers will have no effect, since the fault current must be supplied by the lines, after passing through the current transformers connected therein. By including fuses, as shown at F, in one set of current transformers, some measure of overload protection can be provided. On the current reaching a predetermined limit the fuses will blow, causing the whole of the secondary current from the remaining set of current transformers to flow through the relays. When the length of the pilot wires is considerable, it is usually convenient to insert adjustable resistances, as shown at R (fig. 5), so that the relay tappings may be taken at any convenient point and the tappings afterwards adjusted for equal potential.

It is important to note that when overload fuses are fitted the current transformers used should be capable of wise abnormally high voltages may be impressed on the being safely open-circuited on the secondary side, other-protection circuit during the brief period that the gear is operating.

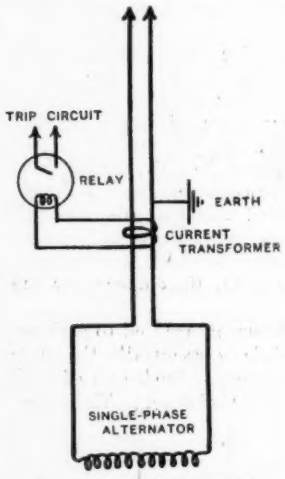


Fig. 6.—Self-balancing Protection of Single-phase Alternator.

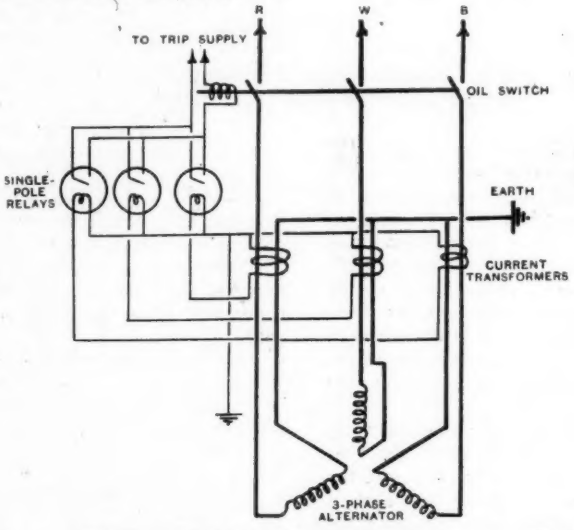


Fig. 7.—Self-balancing Protection of Three-phase Alternator.

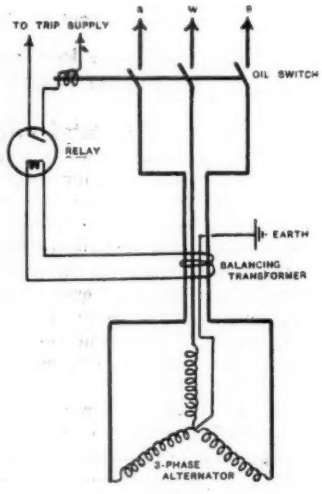


Fig. 8.—Ferranti-Field Protection of Three-phase Alternator.

The form of protection above outlined is termed the balanced-current method, as a distinction from the balanced-voltage method, and is to be preferred as a rule, since it is usually easier to balance sets of current transformers for current ratio than for voltage ratio.

Self-balancing Protection.

This form of protection is somewhat similar to the Merz-Price system, but is more sensitive. Fig. 6 shows the method applied to a single-phase alternator, and fig. 7 shows a polyphase layout. Referring to fig. 6, it will be seen that both ends of the single-phase winding pass through the core of a special current transformer. Under normal conditions the currents in each end of the winding must be equal, no magnetic flux is produced in the current transformer core, and, consequently, no secondary current flows in the relay circuit. The three-phase diagram, fig. 7, shows each phase winding with its balancing transformer, both ends of each winding being taken through the core. The balancing-transformer secondary windings are shown connected in star, together with the one side of each relay.

On consideration it will be seen that any fault developing inside the alternator, either to earth or between phases, will cause more current to flow in the neutral ends of the windings than in the line side. This excess current will magnetise the transformer core on the phase or phases concerned, inducing a secondary current which will operate the relay, if of sufficient magnitude.

This form of protection, just as Merz-Price protection does, suffers from the disadvantage that it is inoperative when faults between turns of the same phase are concerned. Owing to the self-balancing effect of passing both ends of the windings through the current transformer, the practical difficulties of balancing individual current transformers are removed; also, only half the number of current transformers are required, in comparison with Merz-Price protection. Should a fault develop between the low-voltage end turns of two phases, both the Merz-Price and self-balancing arrangements may fail, owing to the resulting circulating current being too feeble to operate the relay. In general, however, either system will protect the major part of the windings.

The Ferranti-Field Protection System.

For the protection of alternators against faults to earth only, the Ferranti-Field system is applicable. The protection is confined to the alternator, as in the systems just described.

Fig. 8 shows its application to a three-phase generator. All three line wires and the neutral pass through the core of a special core-balancing current transformer, and under normal conditions the vector sum of the currents in the three-phase lines is zero at any instant, and while the insulation is sound no current will flow in the earthed neutral. In view of these conditions, no secondary current will be set up in the current transformer.

Considering the diagram (fig. 8), it will be seen that any fault developing beyond the current transformer will not cause any current to flow in the relay circuit. In the case of a fault between phases on the outgoing lines the sum of the three-phase currents will still be zero, whilst in the event of a fault to earth the excess line current will return through the current transformer, *via* the earthed neutral, and the balance will still be maintained. An earth fault in the alternator, however, will cause a return current to flow in the neutral, having no counterpart in the three-phase lines. This neutral current will therefore magnetise the current-transformer core, giving rise to a secondary current which will operate the relay, if sufficiently powerful.

This system has the advantage that it can be readily applied to existing plant, especially where multi-core cables are used for connections. The core-balancing transformer can be obtained so designed that the core may be built around cables after they have been laid in position and connected up. Only one current transformer is required for each generator, and the method is therefore at once simple and convenient to instal.

Before leaving the subject, mention must be made of devices designed to cut off the field excitation of an alternator which has tripped off the bus bars, due to fault conditions arising.

Suppose a machine has tripped out due to an earth

fault developing in the windings: the generator is disconnected from the bus bars, but the prime mover is still driving the alternator, and the latter continues to feed into the fault.

A copper bar burnt out due to a fault is, in itself, a small matter, but if the heavy fault current be maintained the whole of the winding and the laminations in the neighbourhood may be irretrievably damaged, necessitating the complete dismantling of the generator. This, apart from the expense involved, may mean that the machine will be out of commission for some considerable time. Even should a generator trip out and the steam be cut off immediately, the flywheel effect of a large modern turbo-alternator is considerable, and may cause the machine to feed into the fault for some time. If, however, the field excitation be cut off automatically and the winding discharged through a resistance, the trouble will be effectively overcome.

The usual arrangement is to connect special relay coils in parallel with the oil-switch trip coils, so that the two operate simultaneously. The relays are arranged to open the exciter circuit and discharge the field coils. In the event of the protective relay operating, the trip coils are excited and operate, tripping out the oil switch. At the same time the field relays operate, completely isolating the machine electrically.

The above notes show the principles involved in the provision of protection for alternators. The final choice of any one system can only be made after a careful consideration of individual difficulties and requirements.

Synchronous Motors.

An attempt to explain in physical terms the reason why a synchronous electric motor takes a leading current when it is over excited.

By HENRY M. SAYERS, M.I.E.E.

THE plaint of " Non-Mathematician " in his letter of August 9th* will have the sympathy of a good many readers, who find it difficult to give a physical interpretation to vector diagrams and circle diagrams. Speaking as one of them, I think the difficulty is mainly one of dimensions. Any diagram must represent time as a length, or as an angle. The separation of the diagram dimensions into the electrical elements of a machine performance, and the time equivalent of its rotation, is a little troublesome. I have found Silvanus Thompson's " Polyphase Electric Currents " the best guide to one of small mathematical attainments.

Consider, first, a direct-current separately-excited motor, supplied at a constant voltage and driving a load which imposes a constant torque. At a given excitation there will be a current through the armature which is (*a*) proportional to the difference between the supply voltage and the back e.m.f., and (*b*) sufficient to produce the torque required by the load. Evidently the torque is proportional to the current and the field flux; the back e.m.f. is proportional to the field flux and the armature speed. Increase the excitation, altering nothing else: since the flux is increased, the current necessary to produce the load torque is smaller; also the back e.m.f. at the same speed is greater, which tends to reduce the current. Conceivably the flux may be so much increased that, at the same speed, the back e.m.f. is in excess of the supply voltage, when evidently the speed must fall until the difference between the two opposing e.m.f.'s is again sufficient to give a forward current, which, with the increased flux, produces a torque sufficient for the drive. The direct-current motor restores the balance by altering its speed. (In practice, a load which has a torque independent of speed is uncommon. One has to make simplifying assumptions in the way of altering one variable at a time. Evidently, if increasing the excitation leaves the speed and torque unaltered whilst the current is reduced, the efficiency is higher at increased excitation.

Now one can consider a synchronous motor as having, *at any moment*, similar relations between flux, current, and torque. The essential difference is that it cannot alter its speed to meet any changes in one or other of the conditions. The average torque is the average product of the flux and the current in the direction of the supply voltage. The instantaneous current is proportional to the difference between the instantaneous supply voltage and the simultaneous back e.m.f., giving each e.m.f. its proper sign.

Assume that a synchronous motor is running on a constant load, with a constant supply voltage, at unity power factor. Unity power factor means that the current taken is in phase with the supply voltage; in other words, plotting on a time basis the supply voltage and the back e.m.f. waves, the difference between them has a maximum coinciding in time with that of the supply voltage. Also, the product of the average current and the field flux is proportional to the load torque. Now increase the excitation, which increases the back e.m.f., and, if nothing else is altered, will reduce the difference between that e.m.f. and the supply voltage, and therefore the current and the torque as well. But, by the hypothesis, the torque, *i.e.*, the product of the average current and the flux, has to remain the same; in fact, when excitation is increased beyond that necessary for unity power factor, it means that for some parts of each period the back e.m.f. is greater than the simultaneous supply voltage, and the simultaneous current at those times is in the opposite direction to the supply voltage. That has consequences which include (*a*) the current is no longer in phase with the supply voltage; (*b*) at those particular parts of the cycle the rotor is acting as a generator, feeding back current into the supply system. These conditions can only be satisfied by a forward shift of the current with respect to the supply voltage, *i.e.*, the current wave leads the supply-voltage wave. The " feed back " is equivalent to a current wave 90 deg. in advance of the supply-voltage wave. The resultant current, that part of the current wave in the forward or torque-producing direction, combined with that at 90 deg. to the supply voltage, is larger than the torque-producing current at unity power factor. To the extent of the 90 deg. component, the over-excited motor behaves as if it were a condenser, or a generator 90 deg. out of phase, leading, on the supply voltage. That is why an over-excited synchronous motor can be used to correct the power-factor of an inductive load. The mechanical part of the adjustment is an angular shift of the rotor in respect to the stator.

The direct-current motor balances the effect of a change in excitation by a change of speed. The synchronous a.c. motor balances the consequences of a change in excitation by a shift of phase between current (and back e.m.f.) and supply voltage. This seems to me to be the simplest explanation in physical terms of the action. It does not take account of all the actions.

A good way of illustrating the matter is to plot curves of supply and back e.m.f. waves, and resultant currents, for changes in excitation. They will show what occurs when the phase relations of the two e.m.f.'s and their respective magnitudes (or amplitudes) are changed; or, conversely, what phase changes are necessary to give equal average forward torque current for different ratios of the two e.m.f.'s. It will be found by such an experiment that an increase in back e.m.f. or excitation can only be balanced by an advance in phase of the current wave.

* See also correspondence in reply thereto in issues of August 16th, 23rd, and 30th.

Current Engineering Education.

Some Notes on the Highly Important Problem of the Future Policy in England.

(COMMUNICATED.)

EDUCATION in England appears to be rapidly approaching a stage in its history which will appear to later generations as the end of an old order and the beginning of a new. Exactly what form it will take cannot be foretold; possibly it will be marked by some great conference of educational authorities, as suggested by a contemporary recently. There may even be an Education Act; educational policy may be changed; syllabuses may be altered; subjects deleted, other subjects introduced. Such radical alterations will probably only take place in a very gradual manner, and be spread over a number of years. The natural conservatism of Englishmen is not conducive to violent or sudden changes, but that a great landmark in educational history is rapidly approaching, perhaps even more quickly than many of us realise, is evident to all who are carefully watching the signs and portents.

Conferences held by various sections of educational authorities receive much more attention by the Press than ever before. The orations and comments of the leading authorities are noted and criticised, whilst time after time various details of our educational system are brought under the searching gaze of public opinion. In short, the whole subject of education is rapidly being brought into favourable focus for authoritative discussion, criticism, and, in due course, action.

What are the chief features of English education at the present time, more particularly of that branch whose function is the training of engineers? The production and training of engineers is rapidly becoming a more and more complex problem, partly due to the ever-widening field which engineering covers.

At least two features are common to all engineers (the word engineer is used in its true, original sense); all possess a high degree of accurate theoretical engineering knowledge, not only in the section in which they have specialised, but in three or four other correlative sections as well. A man who has made mining engineering his *forte* cannot view his field in correct perspective unless he is also thoroughly conversant with the principles and practice of mechanical engineering, electrical engineering, and geology. So, of course, with any other branch.

Another common attribute of all engineers is high character. Outwardly varying in every detail, under the surface of each is the same tremendous grit, unwavering perseverance, and tireless patience—and of these two essentials character is the greater. Character is a fearful and wonderful thing; incomprehensible and baffling at times, yet the results it achieves, whether good or evil, stand forth clearly. The building of character is a very complex process: every force which shapes human life affects character. It is most emphatically *not* built at school, or college, or university; equally emphatically it *is* powerfully influenced by each and all of these institutions.

The bulk of a man's scientific knowledge is usually assimilated during his college and university years, although much is often learned and studied quite apart from his *alma mater*. Thus, although education is not solely responsible for the training of engineers, it plays a highly important part, a part of such importance that if it is in any degree faulty the product of its system will be equally faulty.

How are the great educational institutions fulfilling their high calling at the present time? This question can perhaps best be answered by studying more closely how engineers are made. As noted above, two things must be obtained by the budding engineer in order to achieve true success, *i.e.*, knowledge and character.

Knowledge is gathered in a variety of ways; some have an aptitude for learning, to others it is sheer hard grind. Some can command the best tuition, books, appliances; others (among them be it remembered some of our greatest engineers) are compelled by circumstances to obtain their theoretical training after a day's toil. Of course, facilities for obtaining such training have improved wonderfully during the last decade, although they are by no means beyond criticism.

Character is being formed continuously from birth onwards. Home life and parental influence are great factors, and every force with which a boy comes into contact has its effect for good or evil on his character. Thus when he goes to his University his character is partly formed, and the most that can be done during the three or four years he spends as a student is to mould, and influence, and shape that character, and to impart to it those qualities that are vital to his success as an engineer. In so far as the University accomplishes this it is successful within the true meaning of success, and by the amount that it fails to achieve this result is it a failure.

A university, then, and I think this statement may be considered true of other departments besides engineering, has two functions, namely, to instil knowledge and to train character, and the training of character, as already stated, is immeasurably the more important.

This is a problem which is causing great uneasiness amongst some of our leading educationists to-day. In the past our universities have turned out trained men of the highest type, second to none in the whole world. To-day, they still turn out such men, the older universities especially having altered but little, but there is also a deplorable tendency to neglect somewhat the training of character and to concentrate on the imparting of more and more knowledge. This tendency is further emphasised by a distinct desire, noticeable in a certain class of student, to concentrate solely and entirely on gaining academic distinction, without regard to the true value of such distinction when obtained at the expense of the development of character. This "passion for degrees," as a contemporary terms it, is exceedingly serious, and requires careful consideration and study. First, is it true that it exists? If so, it constitutes a serious challenge to our whole training system. True education is best seen in the pursuit of learning for its own sake. The sections of his study which a man learns best are always those which he loves most, as distinct from those which, for some reason or other, he is compelled to study. After a careful study of engineering and engineering education for many years I feel bound to admit that such a tendency does exist. It may not appear on the surface, but little grains of evidence collected here, there, and everywhere, leave me little doubt on the question.

What is the reason for the growth of such a desire, for it is certainly of fairly recent growth? The chief one appears to be the fact that, in the eyes of a certain section of employers, the possession of a degree is a distinction which nothing can possibly outweigh, an opinion which reacts very unfavourably on the man without the degree. This fact is well known and appreciated amongst young engineers, with the natural result that every one wants a degree of some kind. How he obtains it is a secondary consideration; whether it is best for his true development does not matter. He realises that unless he obtains a degree, he will carry a tremendous handicap, which practically nothing else can neutralise. Hence true work, sound training, and development of character are neglected for the pursuit of magic letters.

There are, I know, various diplomas and distinctions

which are supposed to rank equivalent to a degree, but in the actual test they do not carry the same weight. An employer requires the services of an engineer, and interviews the candidates. One man simply states that he is a B.Sc., of London; his rival for the appointment explains that he holds somebody's diploma, which is equal to a degree. The psychological effect on the employer is immediate; he knows what a London B.Sc. is, but has never heard of the diploma before, and becomes immediately suspicious of an unknown distinction which is like something else. Very probably no other qualification the second man can offer will be able to recover him the ground he has lost.

Most emphatically the fault is with the employer; he is the man who calls the tune, the student simply dances to it. I am, of course, quite aware that there are many industrial leaders in the country who do know exactly what value to put on a degree, and also on such distinctions as those conferred by the various learned societies, diplomas of provincial colleges, &c., and of course the above assertive statement does not include such men, but their numbers are comparatively few; hence the above position has gradually grown and forced itself upon our attention. It is a remarkable and suggestive fact that quite a number of our leading engineers of mature years possess no other distinctions than membership of the engineering institutions.

It is, of course, perfectly understood that the author has no quarrel with the taking of degrees in essence; all honour, indeed, to the men who are capable of obtaining such distinctions, but it cannot be too strongly emphasised that the mere taking of a degree does not always constitute success, and may in some cases result in definite harm to a man's character and ability.

What is the remedy? The problem is a big one to solve, and for the present suggestions must suffice. We seem to have been led away from the true path of progress, and the first thing to do is to get back to the point where we left the path. That is, decrease the value of any inflated degrees, and restore the proper status to diplomas and distinctions conferred by various institutions and colleges. Then perhaps we can forge ahead in the direction of true success. However, as stated above, this is just a suggestion: possibly some keener brain than mine will be able to direct educational thought and activity along a better and surer path.

There are a number of other very interesting problems which are constantly met with by anyone who closely studies educational theory and progress. One of them, closely allied to that mentioned above, is the question of what kind of training the student engineer is receiving, a question which has received considerable attention of late. Is he merely being coached and "crammed" in order to pass a certain examination on a certain date, or are examinations kept in their proper place, and the development of the man's character made the first duty of the teacher? In the one case the student is simply spoon-fed with loads of facts and formulæ, which he has to learn by heart, the derivation and application of such information being an entirely secondary matter. In the other case in which character is upheld as the premier object of the training, the student is taught to think and reason for himself. Examinations are kept in their proper place, for they *have* a place, and an important one at that, but they are not allowed to distort the student's field of vision. Patience is developed by means of laboratory work (the importance of such work being pointed out). Experimental originality is encouraged, and the theoretical basework is slowly, but very surely, laid.

The relative progress in the two cases appears on the surface to be strongly in favour of the "crammed" student, but that is only superficial. The second man will have laid groundwork and a foundation which will carry the weight of almost any superstructure of science that he decides to erect upon it. True progress will be made, true education proceed, only when character training is the first and principal aim of our training institutions.

The above notes are put forward in order to focus a little more attention on the highly important problem of the future policy of education in England. Perhaps they may provoke some abler pen than mine into action in an earnest endeavour to solve the problem. If so, no one will scan it with keener interest than the author.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

Preparing Olympia for the B.I.F.

It is stated that all records for speed in British steel construction have been broken at Olympia, where two storeys of a new four-storey exhibition building have to be ready in time for the British Industries Fair next February. Demolition of houses on the site began less than five months ago; the second floor of the new building, which is to be the largest in the Empire, will be roofed in by the end of September. The architect says that 5,000 tons of steel have been erected in ten weeks. During one week 800 tons was delivered and erected, as compared with the normal rate in London of 100 tons. Two twenty-ton cranes were brought from the Tyne Bridge to lift the twenty-two-ton girders into place. Some of the columns carry 1,500 tons, the spans—probably the largest in the country—being over 50 ft.

The Electric Propulsion of Ships.

It is not always realised to what extent electricity is now used aboard ship, not only for auxiliary services, but also for propulsion purposes. Considerable publicity has been given to the successful results obtained by the P. & O. twin-screw turbo-electric liner *Viceroy of India*, and it is interesting to note that the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, which manufactured the propulsion equipment, has on order at the present time not only turbo-electric propulsion equipments for three other ships, but also propulsion equipments for two Diesel-electric oil tankers, as mentioned in our last issue. Electricity is also helping shipowners to modernise older vessels, and the British Thomson-Houston Co. has on order six equipments in which the exhaust steam from reciprocating engines is used in turbines driving generators which supply electrical power to motors on the propeller shafts, and generators which are used for electric lighting, heating, cooking, and motor services. The additional power thus made available for propulsion purposes can be used either to increase the speed of the vessels or to maintain the existing speed at greater economy.

The A.E.G. and the American G.E.

An extraordinary general meeting of the Allgemeine Elektrizitäts Gesellschaft on August 27th, approved the allotment of new shares of a nominal value of 30,000,000 marks at the rate of 200 per cent., to the General Electric Co. of America, and also an increase of capital of 23,750,000 marks, bringing the total to 210,000,000 marks. It was announced that agreements binding upon both parties had been entered into to prevent the American company ever acquiring a majority of the share capital of the A.E.G. The following American directors were elected to the board of the A.E.G.: Messrs Owen Young, Gerard Swope, Clarke Minor, Arthur Baldwin, and J. Edmonds.—*Reuter* (Berlin).

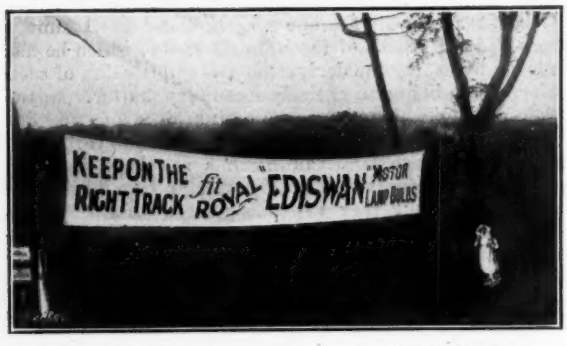
D

Power Station Staffs' Salaries.

The injudicious use of brackets in the table of power station staffs' salaries which appeared in our last issue is likely to cause confusion. The only named grades are the following:—Deputy chief official, Grade 1; power station superintendent, and mains superintendent (in charge of sub-stations), Grade 3; mains superintendent (without charge of sub-stations), Grade 4; and shift charge engineer, Grade 8.

Advertising Ediswan Automobile Lamps.

The accompanying illustration shows how the Edison Swan Electric Co., Ltd, attracted the attention of the half million spectators who gathered on the Ards circuit at Belfast on August 24th to witness the International Tourist Trophy Race.



An Ediswan Advertisement on a Motor Racing Track.

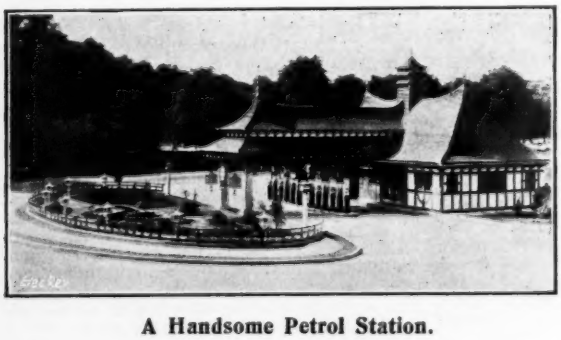
The sign, which was used to advertise "Royal Ediswan" motor lamps, measured 30 ft. long by 5 ft. deep, and was displayed in a prominent position on a steep embankment near the Grand Stand and pits.

United States Electrical Exports.

The total value of electrical goods and machinery exported from the United States during June last was $11,672,425, as compared with $9,254,855 in June, 1928. The classes contributing most to the increase were the following:—Radio apparatus, from $721,690 to $1,684,211; small refrigerators from $744,454 to $1,200,009; d.c. generators, from $114,130 to $274,018; stationary motors, 1 to 200 h.p., from $188,680 to $417,017; accessories and parts for motors, from $204,585 to $298,841; and unspecified apparatus, from $626,504 to $894,419. The largest share of the exports was as usual taken by Canada ($3,196,437). Argentina ($1,047,237) occupied second place, and Brazil ($904,072) was third. Other leading customers were the United Kingdom ($775,457), Australia ($646,151), and Mexico ($530,222). The total value of United States electrical exports during the first half of this year was $70,788,339, an increase of $17,521,472, as compared with the corresponding period of 1928.

Lighting at a Petrol Station.

Among the principal disfigurements of our countryside and beauty spots, the petrol station probably holds first place. It is accordingly very delightful to discover such a petrol station as that illustrated herewith. The picture shows the Park Langley station, Beckenham, Kent, which recently won a



A Handsome Petrol Station.

prize in a "Brighter Petrol Service Station" competition organised by the National Gardens Guild in conjunction with the *Daily Express*. The electrical interest lies in the fact that a special lighting scheme was adopted. The fittings for this were supplied by Messrs. Falk, Stadelmann & Co., Ltd., and installed by Mr. C. H. Taylor, Hither Green Lane, Lewisham.

South African Electrical Imports.

According to the *Board of Trade Journal*, the imports of electrical machinery into the Union of South Africa during the first quarter of the current year were valued at £369,868, while imports of electrical material had a value of £261,470.

The Shipping and Machinery Exhibition.

We regret that in our "Forthcoming Events" last week we gave the period of the above exhibition as from September 10th to 13th. The actual dates are September 12th to 28th.

Turkish Import Duties.

The *Board of Trade Journal* states that certain goods to which most-favoured-nation treatment is accorded by Turkey will not be subject to a provisional increase which is being applied to imports in general as from August 30th, pending the enforcement of the new tariff on October 1st. Among these exempted goods (which include British manufactures) are dynamos and accumulators (present duty 1,000 piastres per 100 kg.); electricity meters (3,750 piastres per 100 kg.); and telegraph, telephone and radio apparatus (4,500 piastres per 100 kg.). The Turkish pound of 100 piastres has a value of about 2s.

A G.E.C. Radio Campaign.

The General Electric Co., Ltd., has prepared a special publicity scheme in connection with its radio apparatus for the coming season. The company's apparatus has been divided into four groups for the purpose—a.c. mains sets, battery-operated sets, loud speakers, and h.t. power units and components—and each group will be dealt with separately in the company's national newspaper advertisements. Special booklets and folders have been produced for distribution. Special attention is being given to the improved "Music

An Attractive "G.E.C." Design.

Magnet" set and to the new "Stork" loud speakers. One of the designs advertising the latter is reproduced herewith. The treatment is novel and attractive. "Osram" valves form the subject of a separate campaign, and the "tenacious coating" of the filament is the leading selling point. The new a.c. mains valves are also given prominence.

Electrical Progress in Portugal.

In the course of a report upon conditions in the north of Portugal (*Board of Trade Journal*, August 29th), the British Consul at Oporto says that the principal source of power is the Lindoso hydro-electric station, distribution in Oporto being municipalised. The service is being steadily extended in the city and environs, purchases of material being usually made through local agents of manufacturers. Plans exist for an Oporto municipal scheme for a new hydro-electric station on a large scale on the River Douro, but no progress has been made during the past year with the project, which is only in an early stage. Towns and villages in the district are being electrified from existing sources of power. The market for electrical fittings and supplies is developing.

The Oporto tramways are owned by a public utility company, which appears to be doing a profitable business. The company's concession, which has a long term to run, grants certain exclusive rights which have been the subject of litigation with the municipality. There is a need for extension of the services which would bring a demand for new material, and interesting developments are looked for in regard to the future working of the services as between the company and the municipality. In the possible event of municipalisation there would probably be large extension plans; in any event it is expected that new tramway and omnibus material will have to be acquired sooner or later.

Bankruptcy Proceedings.

H. W. DAVIES and R. A. DAVIES, 34, Mill Street, Crewe, Cheshire, trading as Davies Bros., cycle and wireless dealers.—The public examination herein was held on August 29th at Crewe, when a statement of affairs was presented which showed liabilities of £574 and assets of £45. It was stated that the business, which was commenced in 1927, had recently declined through unemployment in the town, and profits were insufficient to meet trade expenses. The debtors did not become aware of their position until May, when they were sued. The examination was closed.

A. P. PACIFICO, J. P. PACIFICO, and R. FEITELSON (Comton Wireless Manufacturing Co.), 26-28, Bartholomew Square, E.C.1.—Trustee, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C., released July 10th.

G. WILMINGTON, electrical and radio engineer, 75, Railway Street, Nelson.—Last day for proofs for dividend September 14th. Trustee, Mr. J. W. Carter, Official Receiver, District Bank Chambers, Blackburn.

J. LITTLER, electrical and radio engineer, 9, Hoghton Street, Southport.—Last day for proofs for dividend, September 14th. Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester.

S. W. RICHARDS, radio engineer and electrical contractor, Blackwood Radio and Electrical Supply Depôt, High Street, Blackwood.—Last day for proofs for dividend, September 16th. Trustee, Mr. E. Owen, 34, Park Place, Cardiff.

V. F. MADDOX, electrical and wireless engineer, 6, Homend Street, Ledbury.—Receiving order made August 23rd, on debtor's own petition. First meeting September 7th at the Official Receiver's office, 133, St. Owen Street, Hereford. Public examination, October 7th, at the Shirehall, Hereford.

S. B. WATSON (S. B. Watson & Co.), electrical engineer and contractor, 73, Crouch Street, Colchester.—First meeting held September 3rd, at 9, Arcade Street, Ipswich. Public examination, October 3rd, at the Law Courts, Colchester.

H. V. CHARLEY (Dinas Powis Electrical Supply Co.), Station Road, Dinas Powis.—First and final dividend of 1s. 2½d. in the £, payable September 10th at the Official Receiver's office, 34, Park Place, Cardiff.

Company Liquidations.

LUMINAD, LTD.—Winding up voluntarily. Liquidator, Mr. W. J. Hyson, 86, Harley Street, W.—A meeting of creditors was called for September 6th at Bridewell House, Bride Lane, E.C.

COMPARRI WIRELESS CONTROL SYNDICATE, LTD.—A meeting of members is called for October 7th at 73 and 75, Albion Street, Leeds, to hear an account of the winding up from the liquidator, Mr. H .E. Harwood.

CLYNO ENGINEERING CO., LTD.—Winding up voluntarily. Liquidator, Mr. F. E. Bendall, Midland Chambers, Warwick Passage, Corporation Street, Birmingham. Meeting of creditors September 9th, at the Grand Hotel, Birmingham. Particulars of claims to the liquidator by October 1st.

ELECTRICAL SUNLIGHT & BERGONIE CO., LTD.—A meeting of members is called for September 27th, at the offices of Messrs. J. T. Lewis & Woods, 54, Chancery Lane, W.C.2, to hear an account of the winding up from the liquidator, Mr. H. C. Field.

Trade Announcements.

The Leicester branch of Messrs. T. BEADLE & CO., LTD., of Hull, has been removed to 27, Fox Lane, Leicester, and a new branch has been opened at 34, Heathcoat Street, Nottingham.

PHILIPS LAMPS, LTD., has opened a new depôt for the sale of lamps and fittings at 62, Union Street, Plymouth. (Telephone: Plymouth 3323; telegrams: "Phillamps, Plymouth.")

The telephone numbers of Messrs. A. VANDAM & CO., LTD., Caxton House, Westminster, S.W.1, are now Victoria 1693 and 1694.

The WARDLE ENGINEERING CO., LTD., has appointed Mr. G. E. Whitehead, 102, St. Mary Street, Cardiff, as representative in South Wales in succession to Mr. W. H. Stone, who has joined the TUNGSRAM ELECTRIC LAMP WORKS.

The telephone number of the GENERAL ELECTRIC CO., LTD., has been changed from Regent 7050 to Temple Bar 8,000 (70 lines).

The head office of BELL'S ASBESTOS & ENGINEERING SUPPLIES, LTD., has been transferred to the company's works at Slough. Offices and stocks are being established at 157, Queen Victoria Street and 239, Upper Thames Street, E.C.4. Until these are ready the counter trade is being carried on at the old Southwark Street address.

The telephone numbers of the London office (Bush House) of Messrs. FERRANTI, LTD., have been altered to Temple Bar 6878 and 9325.

As from September 9th the telephone number of the SUN ELECTRICAL CO., LTD., will be Temple Bar 3500.

The telephone number of Messrs. HOPKINSONS, LTD., 34, Norfolk Street, Strand, W.C.2, is now Temple Bar 4541.

The telephone number of Messrs. SPEEDY & EYNON, 22, Essex Street, Strand, W.C.2, has been changed to Temple Bar 6067.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., notifies us that its telephone number is now Temple Bar 4321.

The new telephone number of the SIFAM INSTRUMENT CO., LTD., is Temple Bar 3871. Another change of number is that of Messrs. GILLESPIE & BEALES (the London Sales office of the Macintosh Cable Co., Ltd.), 12, Norfolk Street, W.C.2. The new numbers are Temple Bar 1081-2.

East African Electrical Imports.

The imports of electrical machinery into Kenya and Uganda during last year amounted to £34,445, and of electrical goods and apparatus to £21,353.

Dissolution of Partnership.

MARTIN & BROWN, wireless and electrical engineers, 48, Chapel Street, Hamilton.—Mr. J. P. Brown and Mr. D. H. Martin have dissolved partnership, owing to the retirement of Mr. Brown. Mr. Martin will continue the business.

New Catalogues and Lists.

September calendar-blotters have been received from Messrs. WARREN BROS. (MIDDLESBROUGH), LTD., the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1; Messrs. MAVOR AND COULSON, LTD., Glasgow; Messrs. S. ROGERS & CO., 15, Fitzroy Street, W.1; and POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, W.C.2.

Messrs. BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—September list of electrical accessories supplied by the company. Illustrated and priced.

THE WHITWORTH ELECTRIC LAMP CO., LTD., 6 and 8, Gorleston Street, North End Road, West Kensington, W.14.—A 1929-30 price list of electrical materials, appliances, and accessories, including radio apparatus.

Mr. O. G. KARLOWA, Abford House, Victoria, S.W.1.—An illustrated pamphlet describing the Küppers sag meter for use in connection with overhead transmission lines, &c.

ELECTRIC FIRES, LTD., Heatrae Works, Norwich, Booklet No. 54, a new season's catalogue of electric fires, cookers, water heaters, and other domestic appliances. Profusely illustrated and priced.

The A.E.G. ELECTRIC CO., LTD., 131, Victoria Street, S.W.1.—Domestic appliance booklet containing illustrated particulars and prices of fires, water heaters, &c.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A folder illustrating and describing a new range of "Simplex" reflectors for commercial, industrial and municipal lighting.

Messrs. WINGROVE & ROGERS, LTD., Arundel Chambers, Strand, W.C.2.—An illustrated pamphlet containing particulars and prices of "Victor" electric vehicles for town delivery work.

CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—Two well-illustrated publications dealing with the company's electrical and pneumatic tools and equipment.

Messrs. WOLF & MORGAN, LTD., 66, Victoria Street, S.W.1.—A priced stock list of d.c. and a.c. motors, including fractional h.p. models.

BRITISH INSULATED CABLES, LTD., Prescot, Lancs.—Catalogue No. P.249, containing illustrations and full details of "Prescot" terminal boxes and sealing ends.

FLUIDMETERS, LTD., Winchester House, Victoria Square, Birmingham.—Two illustrated pamphlets describing the Rippingille patent "Fluidmeter," which has been approved by the Board of Trade.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—An illustrated pamphlet describing the Round Island wireless beacon station (Scilly Isles), with particular reference to the "Chloride" battery and control equipment. Also a series of illustrated and priced publications dealing with "Exide" batteries for radio work, including portable set types and trickle chargers.

Recent Contracts.

We recently reported that the GENERAL ELECTRIC CO., LTD., was supplying the rolling stock in connection with the electrification of the Manchester-Altrincham line, the first to be carried out in this country at the standard pressure of 1,500 V d.c. The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, now informs us that it has received the order for the complete substation plant, comprising switchgear, transformers, rotary converters, and control equipment, the last being of the automatic type with remote control, for one of the two sub-stations. In each sub-station there will be six 750-kW, 750-r.p.m. rotary convertors with transformers to take the incoming supply at 11,000 V, three-phase, 50 cycles from the Stretford District Electricity Board, the rotary converters being operated two in series. Although the company states that this is the first instance in Great Britain where rotary convertors are to be operated two in series for railway work, it has manufactured a large number of such sub-station equipments for duty overseas, some of the automatic equipments most recently supplied being five sets for the New South Wales Government Railways and 26 sets for the Great Indian Peninsula Railway.

A contract for patent glass roofing, continuous opening lights with electrically-operated equipment in connection with the new Ford works at Dagenham, Essex, has been awarded to Messrs. Henry Hope & Sons, Smethwick, Birmingham. The value of the contract is stated to be over £80,000.

Domestic Electrification in the United States.

Statistics compiled by the National Electric Light Association show that, at the end of 1928, 19,077,000 homes in the United States were wired for electricity, representing about two-thirds of the total. The most popular appliance was the electric iron, there being about 14½ millions in use. Next in order came vacuum cleaners of which there were about 5,800,000. There were approximately 5,000,000 washing machines, 4,900,000 fans, 4,540,000 toasters, 3,500,000 percolators, 700,000 electrically-driven sewing machines, 755,000 electrical refrigerators, and

numerous other appliances. These and domestic lighting were estimated to have consumed 5,004,960,000 kWh during 1928, representing a total expenditure of $365,016,000.

Battery Manufacturers to Join Forces.

As from September 9th Messrs. Petc & Radford and the Hart Accumulator Co., Ltd., will join forces under the name of the National Accumulator Co., Ltd. The object is the development of sales of portable batteries, particularly for motor cars and radio. This arrangement combines the knowledge and experience of two leading makers, whose activities have extended over 40 years. The new company will offer the two makes of battery—Hart and Peto & Radford (forming, together, a very extensive range). The sales of these batteries will shortly be conducted by the National Accumulator Co., Ltd., from its depôt at 93, Great Portland Street. At this address offices and showrooms have been taken, and specimens of the products of both companies will be on view. An arresting window display will be maintained, and a full battery service given. The personnel of both companies accustomed to deal with the various special requirements has been transferred to Great Portland Street, where it will continue its activities.

Social Event.

The fourth annual sports meeting of the Union Cable Sports and Social Club was held on the club ground, Dagenham, on August 24th, and an interesting programme of running and gymkhana events was carried out under ideal weather conditions, resulting in very fast times being recorded in the running events. At the close of the meeting, Mrs. J. S. Huddleston, supported by Mr. J. Snow Huddleston, president of the club, presented the prizes.

The Persian Electrical Market.

His Majesty's Consul-General at Bushire has forwarded to the Department of Overseas Trade the following information which he has received from Captain C. G. Prior, I.A., Political Agent, Bahrein:—"A very fine launch built in Kuwait and provided with a 60-65 h.p. Kelvin engine by Khalil Kanoo, made its appearance here, and attracted a great deal of attention. I examined the launch and noticed that it was lit by electricity, which is in itself an innovation, but the electric generating set, without battery, was of American origin. I would be glad if you would put me into touch, *via* the Department of Overseas Trade, with makers of such generating sets in England, so that I may recommend their use in launches in preference to those of American manufacture. The launch engine market is at present entirely British, and it is our duty to see that it remains so. Further, the installation of electric light in Bahrein is going to give rise to a large market for electrical accessories, lamp fittings, small machines driven by electricity, etc., and I should like to have full particulars of firms that deal in such articles, with catalogues, so that I can introduce them to appropriate firms, &c. This should be done as soon as possible, or they will look elsewhere for their supply, and, once they become accustomed to placing orders elsewhere, they will turn less readily to the United Kingdom."

The Department of Overseas Trade says that interested firms may forward copies of their catalogues to the Consul-General, British Consulate-General, Bushire, for transmission to Captain Prior, and it asks that it may be informed of any action taken.

A Central Board Contract.

The English Electric Co., Ltd., has received a further order from the Central Electricity Board for two 15,000-kVA 132,000-V 3-phase transformers for the Central Scotland Scheme, for installation at Saltcoates. The two units will each be provided with on-load tap-changing equipment, and will be similar to the four 15,000-kVA and four 10,000-kVA 3-phase units already supplied and on order.

New French Companies.

Among the companies recently formed in France are the Société pour le Transport de l'Énergie Electrique du Massif Central (T.E.M.A.C.), Paris (8 Rue Lamennais), capital four million francs; and La Société d'Electricité des Chutes de l'Orne, Val de Maizet (Calvados), capital 600,000 fr.

Local Exhibition.

Wivenhoe.—In connection with the electric lighting scheme for the district, an exhibition of electrical apparatus and appliances, arranged by the Colchester Corporation, was opened at the Church Hall, Wivenhoe, on August 27th, by the chairman of the Urban Council. The exhibition was under the direction of Mr. E. F. Bacon, commercial assistant to the Colchester undertaking, assisted by the staff, with the co-operation of manufacturers of the apparatus on view. There were practical demonstrations of cookers, lighting appliances, sewing machines, vacuum cleaners, &c.

Canal Haulage in Germany.

The A.E.G. of Berlin is at present engaged on the construction of an electric motor haulage system on the banks of the Rhine-Rhône Canal, between Strassburg, Mulhausen, and Huningen, with a branch to Colmar, a total distance of about 90 miles. Before the war the biggest barge on the canal had a capacity of 150 tons, but barges carrying 280 tons are now being used. The electric locomotives, which will run on the canal bank, will have a rating of 16.5 kW and a track of 23½ in. They will work upon d.c. at 600 V.

Columbia Company to Make Radio Sets.

It was announced this week that the Columbia Graphophone Co. intends to take up the manufacture of radio receiving sets. It is expected that the company will exhibit at the forthcoming Radio Exhibition. The managing director of the company gave it as his opinion that in the near future the gramophone and radio receiver in combination will be generally adopted.

Proposed Aluminium Works in Russia.

It is proposed to establish an aluminium works in connection with the large hydro-electric works on the Dnieper, the raw material being bauxite derived from the Tichvin district. It is intended to use the process devised by Prof. Kuznezoff and M. Shukovosi. The output of aluminium is estimated at 10,000 tons per annum.

Canadian Radio Production.

Official statistics of the output of Canadian radio apparatus manufacturers during 1928 show that the 45 principal producers turned out goods to the value of nearly £13,000,000, representing an increase of 45 per cent. upon the previous year's figure. The number of complete sets produced rose from 47,500 to over 81,000. The production also included 1,556,920 valves and 3,220 mains units.

Czecho-Slovakian Electrical Imports.

According to the August *Review* of the Anglo-International Bank, the imports of electrical machinery and apparatus into Czecho-Slovakia during the first six months of this year were valued at 175,500,000 (£1,070,000), as compared with 103,700,000 (£632,000) during the first half of 1928.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Sept. 3rd.	Fortnight's inc or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3½d. to 4d.	...
a	,, Perchlorate ... ... ,,	5¼d.	...
a	Shellac ... ... per cwt.	£18 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3⅝d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£192	...
	Grade II... ... ... ,, ,,	£135	...
	Grade III ... ... ,, ,,	£71	...
c	Brass (rolled metal 2" to 12" basis) per lb.	10¼d.	...
c	,, Tubes (solid drawn) ... ,,	1/0½ to 1/1	...
c	,, Wire, basis ... ... ,,	11½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 15s.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£94 15s.	5/- inc.
d	,, ,, H.C. Wire per lb.	11⅛d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	10½d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/6	...
l	,, Wire, galv. No. 8. P.O. qual. ,	£21	...
g	Lead, English pig ... ... ,,	£25	1£/- inc.
g	Mercury ... ... per bot.	£22 5s. to £22 10s.	2/6 to 5/- inc.
e	Mica (in original cases small ... per lb.	3d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings ,,	1/3½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/3½	...
p	,, ,, wire... ... ... ,,	1/6½	...
o	Platinum ... ... per oz.	£13 17s. 6d.	...
d	Silicium Bronze Wire ... ... per lb.	1/2½	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£204 15s. to £205 5s.	£5 15/- dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

In the course of their letter dated August 31st, Messrs. James Forster & Co. state that with transactions amounting to over 7,000 tons during last week, lead values advanced 6s. 3d. per ton, a surprising result after such an effort. Apparently the demand has been purely professional as consumers have been little in evidence. There is no lack of lead for all legitimate needs, and therefore no reason for advancing values apart from speculative activity.

American Activity in Russia.

During the recent stay in Russia of the United States commercial and trading mission, it is reported that Mr. Bennett, vice-president of the Westinghouse Company, was offered various concessions for the construction of power stations, including two in the Donetz basin, a southern station for the supply of the region of Nischni-Novgorod, a peat power station for Leningrad, and a hydro-electric works in Georgia. In the case of manufacturing, concessions were offered to the company for the establishment of a works for the production of measuring apparatus, a turbo-generator works in the Ukraine, and a works for the production of domestic appliances, such as vacuum-cleaners, ice safes, &c. The American company is said to be interested in some of the schemes.

Unemployment.

There was a decrease of 5,768 in the number of registered unemployed during the week ended August 19th. At that date the total was 1,162,300, as compared with 1,168,068 on August 12th, and 1,308,160 on August 20th, 1928.

For Sale.

The Government of Somaliland invites offers for 9-kW generating sets. Rhondda Tramways Co., Ltd., invites offers for surplus generating plant, &c. (See our advertisement pages to-day.)

Electrical Exhibition at Milford Haven.

The Urban District Council invites application for stands at the above exhibition, to be held on October 2nd-4th at the Masonic Hall, Milford Haven. (See our advertisement pages to-day.)

The Irish Radio Exhibition.

The Irish Free State Radio Exhibition is to be held at the Mansion House, Dublin, from October 26th to November 1st.

British Boilers for Poland.

Messrs. BABCOCK & WILCOX, LTD., are reported to have purchased recently 49 per cent. of the shares in the largest Polish boiler works, the Zieleniewski Fitzner Gamper Co., and to have concluded simultaneously an agreement by virtue of which all parts of Babcock & Wilcox boilers will be manufactured in Poland. The British company, it is stated, will supply the necessary funds for the modernisation of the plant. The technical work will be carried out by local experts, but there will be British financial supervision.—*Reuter* (Warsaw).

Lighting and Power Notes.

Birtley.—INQUIRY.—A Ministry of Health inquiry was held recently relative to the application of the Parish Council for a loan of £2,600 for the purpose of public lighting by electricity. The application was opposed by the Newcastle and Gateshead Gas Co. and the Birtley Iron Co. It was stated that the proposed scheme would effect a saving of approximately 1d. in the £ on the rates, whilst it would provide work for the unemployed.

Blackpool.—AUTUMN ILLUMINATIONS.—Arrangements are well in hand for the autumn illuminations, which are to take place from September 21st to October 21st. This year, in addition to illuminating the Central pier, it is hoped that the North and Victoria piers will also be included in the scheme. In all about 10,000 coloured lamps will be used. The lights will stretch the entire length of the promenade, a distance of about three and a half miles, and will include many novelties of electrical illumination.

Bolton.—YEAR'S WORKING.—We have received from Mr. H. E. Annett, borough electrical engineer and manager, a statement of accounts of the Corporation Electricity Department for the year ended March 31st last. The total revenue amounted to £310,333, as compared with £310,316 in the preceding year. The working expenditure totalled £131,328, as against £129,858, leaving a gross profit of £179,005 (£180,458). After capital and other charges were deducted there remained a net surplus of £53,444, as compared with £37,459 in 1927-28. During the year the capital expenditure amounted to £40,802, and included £12,315 for machinery and plant, £12,086 for mains, and £8,276 for services. The total now spent on the undertaking stands at £1,978,914. The electrical energy sold for all purposes increased from 64,466,454 to 66,121,996 kWh, and the maximum supply demanded from 29,000 to 30,800 kW. The average price obtained per kWh fell from 1.13d. to 1.10d.

Clitheroe.—WAYLEAVES.—A Ministry of Transport inquiry was held on August 28th into an application by the Corporation for compulsory wayleaves for a transmission line from Chatburn to Grindleton. Several landowners lodged their objections and it was explained that the real dispute was the amount of rental to be paid. The Corporation had offered 2s. 6d. per pole, leg, or stay in meadowland, and 1s. elsewhere, and it was stated that these rentals were similar to those prevailing in other parts of the country. The landowners claimed that 2s. 6d. per pole and 1s. per stay wire should be allowed irrespective of the nature of the land. The Ministry's decision will be announced in due course.

Continental.—FRANCE.—The Société des Forces Motrices Bonne et Drac of Lyons has recently secured a concession to establish a hydro-electric station to utilise falls on the River Bonne Inférieure and the River Drac in the Department of Isère.

RUSSIA. — The programme of Soviet electricity schemes, for the financial year 1929-30, includes the commencement of the construction of ten new power stations. These are: One in the Malaia Vichera region, not far from Leningrad (132,000 kW); at Bobrikovo, near Moscow (150,000 kW); at Youchsk (150,000 kW); at Samara (22,000 kW); at Baksan, in the Northern Caucasus (25,000 kW); at Kouznetz (44,000 kW); at Azerbaidjan (22,500 kW); at Kadyr (13,000 kW); with additional stations at Moscow (75,000 kW) and at Leningrad (30 to 40,000 kW). The construction of those stations previously arranged for at Dnieprostroi and at Svir is to be proceeded with actively. According to the *Izvestia* the capital invested in electric power supply throughout the country, which at present amounts to 296,000,000 roubles, will be raised to 458,000,000 during 1930.

It is also proposed that a new station should be erected 65 kilometres from Leningrad, on the site of peat deposits at Nazieff, and be equipped with four sets of 44,000-kW capacity.

Eastbourne.—LOANS.—The Corporation Electricity Committee is to seek sanction to loans of £13,552 for laying an 11,000-V feeder to a new sub-station at Upperton Road, and £28,678 for the provision of switchgear and transformers for bulk supply.

BULK SUPPLY.—The Corporation Electricity Committee has received a letter from Messrs. Rooper & Chalmers, consulting engineers, regarding an application now being made by Messrs. Johnson & Phillips for power to supply electricity in the Chailey and Eastbourne Unions south of Ringmer. The consulting engineers desired to know upon what terms the Corporation would be prepared to give Messrs. Johnson & Phillips a bulk supply at some point near the Corporation's area boundary. The committee decided to reply that a definite answer could not be given until the Corporation had obtained the necessary power to extend its area of supply.

Fairlie.—ELECTRICITY SCHEME.—The work in connection with the installation of electric cables at Fairlie, Ayrshire, was commenced on Thursday, August 29th, by the Ayrshire Electricity Board. The supply to the southern part of the village in the parish of West Kilbride is held up on account of a dispute with the West Kilbride Electric & Lighting Co., Ltd., which in terms of its agreement claims the right to supply this portion of the village. A decision favourable to the Ayrshire Board was given recently by the sheriff substitute at Kilmarnock, but an appeal has been lodged by the company to the sheriff principal. This, however, cannot be heard until October, and meanwhile the work in the southern part of the village cannot be proceeded with. The lines are to be laid underground in the main streets.

Hastings.—ELECTRICITY SUPPLY EXTENSIONS.—The Corporation Electricity Committee has decided to extend mains and install transformers to give supplies to Northiam and Battle, at a cost of £2,553.

Herne Bay.—FLOODLIGHTING.— The Urban District Council Pier Committee has considered estimates of the cost of floodlighting the clock tower, Grand Pier Pavilion and the King's Hall, but owing to the cost of carrying out such schemes makes no recommendation with regard thereto. The cost of floodlighting the clock tower (according to one scheme) would be £221, and for another, £197. The Committee is, however, obtaining estimates for strip-lighting the Grand Pier Pavilion and the King's Hall, and will make recommendations later.

Honley.—ELECTRICITY SUPPLY CHANGES.—At a meeting of the Urban District Council held on August 27th, it was decided to adopt a scheme for the purchase of the electricity supply at a pressure of 10,000 V, instead of the present pressure of 400 V. As a result of the change, it was stated that a saving of at least £80 per annum would be made. The Council decided to apply to the Electricity Commissioners for sanction to the change and also for a loan of £1,100 to meet expenses incurred thereby.

Hull.—SPECIAL LIGHTING CHARGE.—The Corporation Electricity Department is to supply electricity during the forthcoming Civic and Empire Week for additional external lighting to existing consumers at a specially reduced rate.

CHANGE-OVER DECISION.—At a recent meeting of the Sculcoates Board of Guardians a letter from the Hull Corporation electrical engineer was read, requesting that he might have an opportunity of conferring with the Board regarding the proposed change-over to the Corporation for its supply of electricity. The Board had previously been recommended by its Works Committee not to proceed with the proposed change-over scheme, since, it was stated, it would be dearer to use the Corporation's supply. The Board decided to grant the city engineer's request.

LOAN SANCTIONED. — The Corporation Electricity Committee has obtained sanction to a loan of £79,000 for extensions.

Irish Free State.—THE SHANNON SCHEME.—Such good progress has been made in the work connected with the Shannon hydro-electric power scheme that the Electricity Supply Board expects that, by the end of the current year, the distribution network in all towns and villages of over 500 inhabitants within easy reach of the main transmission lines will be completed. There are 130 centres, some with electricity undertakings of their own, which have already been absorbed into the scheme, or are awaiting absorption. Up to the present, 5,600 posts have been erected, fitted with 50,000 insulators, and carrying about 700 miles of wires. There remain to be erected 1,500 poles, which will be fitted with 13,000 insulators, and carry 200 miles of wires. For the supply of the networks 72 pole transformers and 67 kiosks will be erected, of which 39 pole stations and 25 kiosks are already in position. Pending the completion of the Shannon power station, some of the towns and villages on the Leinster loop are deriving a temporary supply from the Pigeon House station, Dublin.

Constructional work on the Ardnacrusha section has now been completed, and on August 27th water from the canal was let through the overflow lock into the tail race, which now opens into the river near the Lax weir. It is understood that operations in the Abbey river in connection with future navigation will be taken in hand, as the Corporation is prepared to contribute its quota towards the construction of the new bridge at Athlunkard Street. One of the operating turbines is now undergoing tests.

DUNGARVAN.—A special meeting of the Urban District Council was held recently for the purpose of meeting a representative sent by the Electricity Supply Board to make arrangements for the public lighting of the town for the coming year. The meeting came to a satisfactory arrangement, under which the cost of lighting the town for the year 1929-30 will be £245. Hitherto the town's lighting bill from the local electricity undertaking has been £270 a year.

LIMERICK.—The Corporation Public Lighting Committee is considering the question of lighting the whole of the city by electricity. At present the major portion of the public lighting is done by gas, for which the Corporation pays an annual sum of about £1,400. The Electricity Supply Board has appointed a representative to attend a meeting of the Corporation, and the future lighting of the city will depend on the estimate that the Supply Board will place before the Corporation.

LOUGHREA, CO. GALWAY.—The electricity undertaking owned by the Loughrea Electric Power & Lighting Co., Ltd., has been purchased by the Electricity Supply Board for £3,500.

Kettering.—SPECIAL ORDER OPPOSED.—The Urban District Council on August 28th decided to oppose an application by Mr. Matthews for an Order to supply electricity in an area covering 584 square miles in the counties of Leicester, Rutland, Northampton, and the Soke of Peterborough. The Council also decided to apply for its own Order to distribute electricity in an extensive rural area including the parishes of Corby, Cottingham, Great Oakley, Great Weldon, Little Weldon, Stanton, Gretton, Rockingham, Ashley, and Stoke Albany.

London.—SPECIAL ELECTRICITY CHARGE.—The City of London Electric Lighting Co., Ltd., has issued a special tariff for electricity to encourage the use in City offices of low temperature electric heaters. The rate for this purpose is to be ½d. per kWh from 7 p.m. to 10 a.m., and ¾d. per kWh for the rest of the day.

Oldham.—MAINS ECONOMY PROPOSAL.—The Corporation has abandoned for the present a proposal for effecting saving in connection with the lighting of new streets and the development of land for residential purposes by laying only one set of mains, either gas or electric, for street lighting and domestic lighting and heating purposes.

Peru.—HYDRO-ELECTRIC DEVELOPMENTS.—A contract will shortly be placed for the largest hydro-electric plant yet erected in Peru, to develop water-power rights on the Rio Mantaro granted to a leading foreign copper-producing company. A reservoir will be constructed on the Junin Lake, and above this, at Oroya, at an altitude of 12,180 ft., a dam will be built. The total cost is estimated at £P1,200,000.—*Reuter's Trade Service* (Lima).

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LYNN.—Lighting: A reduction of ½d. per kWh.

MAIDSTONE.—Flat rate: From 6d. to 5½d. per kWh.

SWANSEA.—Lighting: From 5d. to 4½d. per kWh from January 1st next. Maximum demand supplies: The increase of 10 per cent. added during the war to be discontinued. Heating and cooking during summer quarters: From 1d. to ¾d. per kWh.

ABERDEEN.—Flat rate: From 5d. to 4½d. per kWh. Maximum demand rate for the first hour daily: From 7½d. to 7d.

Manchester.—PROGRESS DURING MAY.—During the month of May, the Corporation electricity undertaking showed an increase in connections of 1,847 kW, bringing the total up to 388,454 kW; and the number of applications received for supply, including those for additional supplies, was 857, representing a total of 2,440 kW. There was an increase of 69 in the number of hired cookers connected, bringing the total number of hired cookers actually connected to 5,332. Applications for the hire of cookers totalled 83. Two new sub-stations were put into commission and additional plant was installed at four existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 6,398 consumers up to June 14th, and sanction has been given and work was in progress involving 1,510 consumers. Sanction to the change-over had also been obtained for the Whalley Range, Didsbury, and Chorlton-cum-Hardy areas involving 509 consumers.

Rhyl.—ILLUMINATIONS.—The Corporation Electricity Committee is preparing a scheme for the illumination of the whole of the seafront for the end of September and the beginning of October, and has invited the tradespeople to participate in a scheme of town illuminations.

Salford.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. L. Romero) for the year ended March 31st last show a total revenue of £307,669, as compared with £318,824 in the preceding year. The working expenditure increased from £157,924 to £171,527, leaving a gross profit of £136,142 (£160,899), to which was added interest on investments of £6,049 and an unemployment grant of £17,219, making a total of £159,410 available. Capital and other charges absorbed £129,584, and there was a net surplus of £29,826, as compared with £55,663 in 1927-28. A contribution of £12,700 was made to the city rate. The total net capital expenditure during the year amounted to £90,634, and included £28,478 for mains and services, and £34,450 for machinery for the Agecroft power station. The sales of electrical energy increased from 60,696,636 to 62,707,512 kWh, and the maximum supply demanded from 24,500 to 25,240 kW. The average price obtained per kWh fell from 1.23d. to 1.15d. As a result of the installation of additional plant at the Agecroft power station, the Frederick Road station will shut down at the beginning of the year. The supply of electricity in bulk to the Eccles Corporation was terminated in September last.

Sheffield.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to a loan of £50,000 for wiring in connection with a hire-purchase scheme.

METER STAMPING.—The Corporation Electricity Committee has decided not to support the resolution of the Newcastle Corporation for the certification and stamping of all electricity meters.

Southend-on-Sea.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £6,645 for the installation of a 1,500-kW motor generator.

INQUIRY.—The Electricity Commissioners have informed the Council that an inquiry will be held in September into its application for sanction to a loan of £66,000 for the installation of generating plant and accessories in place of existing steam and Diesel plant. The Commissioners have also stated that, having regard to the provisions of the South-East England Scheme, they thought it advisable that the question of bulk supply should be considered, and that the Central Electricity Board would be represented at the inquiry.

Special Orders.—Applications have been made for Special Orders by the North Cornwall Ice & Cold Storage Co., Ltd., trading as the Padstow Electric Supply Co., to supply electricity in the urban district of Padstow and in the parishes of Padstow Rural and Saint Merryn in the rural district of Saint Columb Major; and by the Leicestershire & Warwickshire Electric Power Co. to supply electricity in the rural districts of Belvoir and Hallaton, and in parts of the rural districts of Billesdon, Melton Mowbray, Barrow-upon-Soar, Loughborough, and Market Harborough.

The Electricity Commissioners have submitted to the Ministry of Transport for confirmation a Special Order made by them authorising the York Corporation to supply electricity in parts of the rural districts of Escrick, Pocklington, Easingwold, Flaxton, Malton, and Great Ouseburn.

Springhead.—OVERHEAD LINES.—The Urban District Council has decided not to oppose the application of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board for permission to erect overhead lines in the district for the supply of electricity.

Stoke-on-Trent.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the borrowing of £35,920 for mains and plant, and the cost of changing consumers' apparatus.

Torquay.—POWER DISCOUNT.—The Corporation Electricity Committee has decided that the discount for prompt payment of accounts for electrical energy used for power purposes under the special sliding scale shall be at the rate of 5 per cent. instead of 2½ per cent.

TRAMWAY ELECTRICITY CHARGE.—Negotiations between the Corporation and the Torquay Tramways Co., Ltd., concerning a difference that had arisen out of the terms of the agreement for the price of the electricity supplied to the company, have resulted in an offer by the company to pay a charge, based upon 9d. per ton of coal instead of 1s. 7d., and the Committee agreed to accept this for the remaining term of the agreement.

United States.—HYDRO-ELECTRIC DEVELOPMENTS.—According to *Power*, a "New Niagara" is being planned in the mountains of North Carolina and Tennessee by the Aluminum Company of America, which is to spend $125,000,000 in the development of hydro-electric resources. At eight separate dams electric power exceeding in magnitude the energy now generated by Niagara Falls will be generated. Seven of the eight projects will be in western North Carolina and

the other in Tennessee. The scheme represents what is said to be one of the largest and most ambitious power developments in the United States, and will require seven years to execute. The recent formation of the Natahala Power and Light Company, with principal offices at Bryson City, N.C., and an authorised capital stock of $10,000,000, is declared to be a step in the plans of the Aluminium Company. The lakes caused by damming streams will submerge the towns of Almond, Bushnell, Judson, Wesser, Forney's Creek, Eppes Springs, and several smaller villages. The cost of diverting railways and highways is given as $1,700,000. The Aluminum Company of America acquired its first power site in western North Carolina in 1905. Two plants are now in operation and a third is under construction. The first step in the extensive plans for development of the "New Niagara" will be the construction of a plant at Fontana, on the Tennessee River. Two others are planned at Bushnell, near the junction of the Tennessee and Tuckasegee Rivers, one at Needmore and one at Acqueon.

Tramway and Railway Notes.

Canada.—OIL-ELECTRIC LOCOMOTIVES.—The initial run of the new oil-electric locomotive of the Canadian National Railways, which took place recently from Montreal to Toronto, proved eminently satisfactory. At times a speed of 65 m.p.h. was reached, and by the use of fuel oil the running costs were reduced by almost 70 per cent.

Continental.—BELGIUM.—According to a report recently issued by the Société Nationale des Chemins de Fer Vicinaux, of Brussels, the company is proceeding rapidly with the work of electrifying its local railways interrupted by the war. During the past year eight lines have been electrified, and work has been commenced on six others, while plans are in preparation for the electrification of sixteen further lines.

FRANCE.—According to the recently issued report for 1928 the Société des Transports en Commun de la Région Parisienne, the number of tramcar-miles run during 1928 amounted to 64,064,232, and the number of passengers carried increased by 6.1 per cent. to 725,563,463. The total receipts amounted to 406,840,172 francs (£3,280,970), an increase of 6.62 per cent., the receipts per car-mile being 12.039d. At the end of the year the company possessed 2,281 motor-equipped cars and 871 trailers.

SWITZERLAND.—The electric railway which has recently been completed between Visp and Zermatt is the first combined rack and adhesion line in Switzerland to be operated by single-phase a.c.

GERMANY.—Work is well in hand on the construction of an electric railway up the Zugspitze mountain and the line is expected to be completed by May, 1930. The Zugspitze (9,720 ft.) is the highest peak in Germany, and the Austro-Bavarian border line runs across its summit. A mountain railway from Ehrwald in the Tyrol has been in existence since 1926, but the new line is the first attempt to conquer the Zugspitze from the Bavarian side. The line begins at Garmisch-Partenkirchen, about an hour and a half by rail from Munich, and about 12 miles distant from the peak. The total cost of the railway is estimated at £625,000.

POLAND.—The Conference of the International Union of Tramways, to be held in Warsaw in 1930, will commence on June 29th and continue till July 6th.

Irish Free State.—DUBLIN.—The failure of the Free State Ministry for Industry and Commerce to persuade the parties concerned in the Dublin tramway strike to come to any agreement has resulted in the formation of a court of inquiry to investigate the matter. In a letter to the general manager of the tramway company, Mr. Campbell Ferguson, Assistant Secretary to the Ministry, said that he considered that the company, by its refusal to restore the service pending the conclusion of the inquiry, had acted with complete disregard for the public interest. The cause of the strike is the refusal of the employés of the Dublin United Tramways Co. to accept a reduction of 10 per cent. in wages.

Middlesex.—RENEWAL OF LEASE.—The negotiations of the County Council with the Underground combine concerning the renewal of the lease of the Metropolitan Electric Tramways are expected to be completed this month. If the lease is renewed the combine states that it is prepared to undertake improvements that will give North London one of the most efficient and comfortable tramway systems in Europe.

Scarborough.—TRAMWAY PURCHASE OFFER DECLINED.—With regard to the proposed purchase of the Scarborough tramway undertaking by the Corporation, the town clerk has been instructed to inform Mr. A. E. Hoare that the purchase price suggested is such as to render any further negotiations at present of no useful purpose.

The L.N.E. Railway Co.—SUBURBAN EXPERIMENTS.—Although plans for railway development are necessarily awaiting the return of Mr. J. H. Thomas from Canada, *The Times* states that certain of the railway companies are already carrying out experiments connected with their new schemes. A good deal has been heard recently, both in the House of Commons and outside, about the electrification of Liverpool Street station. It is now learnt that the London and North-Eastern Railway Co. has been running specially-timed goods trains over its old Great Eastern suburban section on Sundays, in order to see what revision would be necessary in the running times of regular goods trains should any electrification scheme be adopted.

Venezuela.—DIESEL-ELECTRIC SERVICE.—In order to oppose motor transport competition a Diesel-electric service has been inaugurated by the Venezuela Central Railway between Caracas and Ocumare.

Telegraph and Telephone Notes.

Germany.—ROADSIDE TELEPHONES.—A German company is inaugurating a telephone service for motorists. It is intended to install a telephone box connected to the nearest garage at every half-mile of road, commencing with the Berlin-Leipzig road. For an annual payment of about 15s. motorists will be provided with a key, which will enable them to use the telephone to call up the garage for assistance.

Japan.—PUBLIC OR PRIVATE OWNERSHIP?—The *Financial Times* states that the Japanese Minister of Communications is considering the advisability of transferring the telephone service to private management. There are at present 850,000 telephones in operation, and since the earthquake the system has been completely modernised. If it is decided to take this step, our contemporary says, there will be extremely keen competition for the concession between the Swedish Ericsson concern and the International Telephone and Telegraph Corporation.

Newcastle-upon-Tyne.—SHIP-TO-SHORE TELEPHONY.—To facilitate the docking of vessels in the port of Newcastle the Tyne Improvement Commission is establishing a ship-to-shore telephone service. Arrangements have been made with the G.P.O. to provide direct lines from the North Shields exchange to seven points at the docks. In each berth vessels desiring to participate in the scheme will be provided with portable instruments connected by a length of cable to the telephone system ashore. By this means subscribers will be able to get into touch with the vessels directly and quickly.

New Zealand.—THE WIRELESS-CABLE MERGER.—A measure giving formal approval to the wireless and cable merger scheme was introduced into the New Zealand House of Representatives on August 27th. Sir Joseph Ward, Prime Minister, criticised the scheme, stating that it was regrettable that the British Government had relinquished its paramount interest in the beam system to become merely a part proprietor. He also thought that the sale of the Pacific cable was a grave mistake.

Russia.—NEW TELEGRAPH BUILDING IN MOSCOW.—The official Tass Agency publishes the following:—"The new Central Telegraph Building at Moscow, which is equipped with the latest machinery, was ceremonially opened on August 30th in the presence of a special delegation from the German Posts and Telegraphs Department. The building cost 10,200,000 roubles and was designed and erected by Soviet engineers in two years. The new office is capable of handling 4,000,000 words daily."—*Reuter* (Moscow).

Switzerland.—TELEPHONE *v.* TELEGRAPH.—A return recently issued by the Swiss telegraph and telephone authorities shows that, while the use of the telephone is rapidly growing in Switzerland, this is being accompanied by a marked decline in the use of the telegraph service. During the first half of the current year, while there was an increase of over 11 per cent. in the number of telephonic communications, there was a fall of 55,000 in the number of telegrams. For some years the Swiss telegraph service has been worked at a loss—last year's deficit being £68,000—whereas in 1928 the telephone department made a profit of £176,000.

Trans-Atlantic Telephony.—With reference to the note appearing under this heading on p. 360 of our last issue, the main link of the new cable, which will run from Armagh Head, in County Mayo, to Newfoundland, will be the longest submarine telephone cable in operation. Hitherto it has not been possible to send clear telephone messages over a distance of 1,800 miles without the use of intermediate repeating stations. For this reason no previous attempt has been made to lay a long-distance submarine telephone cable.

The difficulty has now been overcome by the use of a new series of alloys as loading material for the cable and the adoption of a new substance known as "paragutta" for insulating the conductor. With these improvements it is expected that the New York-London cable will give a high efficiency, with freedom from variations, which have often been found with radio circuits hitherto, and with the same degree of reliability and secrecy as is obtained in local telephone calls.

It is estimated that the work of laying the cable and completing the land connections will occupy three years, but it is hoped to expedite the work, so as to bring the new service into commercial use before the end of 1932.

Inauguration of New Services. — The radio-telephone services between New York and Dublin, Belfast, and the Isle of Man were inaugurated last week. The system employs the new Northern Ireland to England (via the Isle of Man) telephone cable, the radio part being transmitted from Rugby Mr. Heffernan, Parliamentary Secretary to the Irish Free State Minister for Posts and Telegraphs, had a conversation with Mr. Miller, of the American Telegraph & Telephone Co., and reported excellent results. The cost of a three-minute call is £9 6s.

Canadian Extension.—The Postmaster-General announced last week that as from September 1st the Canadian end of the trans-Atlantic service would be extended to Moose Jaw and Saskatoon, Saskatchewan.

The Telephone Service.—New Automatic Exchange Opened.—On Saturday last the Metropolitan exchange, London, went over to automatic working. The new exchange has a capacity of 10,000 lines and is situated in Wood Street, E.C.; the new National exchange, which is to be opened to-morrow (Saturday) is in the same building and a third exchange—Empire—is also there. The change-over, at which Colonel Sir Thomas F. Purves, the engineer-in-chief of the Post Office, was present, took about five minutes to carry out.

Radio Notes.

Argentina.—Broadcast Relay to Montevideo.—A programme of opera which was given at the Colon Theatre, Buenos Aires, was recently transmitted by landline to the banks of the Rio de la Plata, where it passed over an under-water cable which had been specially designed for the International Telephone Service. The transmission was continued to Montevideo by landline. Special amplifiers were introduced at the theatre and along the route, and specially balanced submarine cable was used to span the 35 miles of water between the banks of the river. The broadcast was "put on the air" under the auspices of Don Santin Carlos Rossi, Uruguayan Minister of Public Instruction, who exchanged greetings by radio with Senor Cantilo, Mayor of Buenos Aires. Don Rossi gave it as his opinion that the transmission was perfect, and pointed out that it was bound to strengthen "the fraternal friendship of the peoples of the Plata." It is proposed to furnish Uruguayan radio listeners with complete programmes of music from Buenos Aires. The submarine cable used in the Buenos Aires-Montevideo broadcast was made at the Woolwich works of Standard Telephones & Cables, Ltd.

Australia.—Transfer of Sydney Station.—The Sydney station of the New South Wales Broadcasting Co., Ltd. (2FC), was recently transferred to the control of the Australian Broadcasting Co., Ltd. In a valedictory address, Mr. G. Wright, chairman of the company, spoke of the rapid progress which the station had made and stated that it now served 100,000 listeners in New South Wales. The proportion of the revenue which had been spent on programmes (63.68 per cent.) compared very favourably with the 63.07 per cent. recorded by the British Broadcasting Corporation.

The Australian Broadcasting Co., Ltd., was recently formed, with a capital of £100,000, to take over existing stations and to erect relays, receiving a concession from the Federal Government.

France.—New High-Power Stations.—*World-Radio* states that the small Nice-Juan les Pins station on the French Riviera is to be replaced by a station of greater power, to be erected at Cros de Cagnes, about 10 miles west of Nice.

The aerial power of the Bordeaux-Lafayette station is shortly to be raised from 1 kW to 35 kW.

Geneva.—League of Nations.—Arrangements have been made by the B.B.C. for relaying from Geneva four talks by British delegates describing the work of the League of Nations Assembly, which will be broadcast from 2LO, 5XX and other stations, on Thursday evenings at 10 p.m. Mr. Arthur Henderson, the Foreign Secretary and leader of the British Delegation, was to speak for fifteen minutes on September 5th, and Viscount Cecil, Mrs. M. A. Hamilton, M.P., and Professor P. J. Baker, M.P., will speak on the 12th, 19th, and 26th, respectively.

Norway.—The New Oslo Station.—The big new broadcasting station at Oslo is to be re-equipped for long-wave transmission, as it has been found that the short wave for which it was intended has failed to carry the distance anticipated. The new wave-length will be 1,072 metres, which was one of those allocated to Norway by the recent Prague Conference.—*Reuter* (Oslo).

Russia.—A Long Land-Line.—The Soviet postal authorities have lately placed a contract with the Siemens and Halske Co. of Berlin for the installation of a telephone cable to connect the wireless broadcasting studio in Moscow with the transmitting station about 25 miles away.

The Regional Scheme.—Site for Northern Station.—It is announced that the British Broadcasting Corporation has secured an option on a site at Pole Moor, Slaithwaite, Yorks., for the erection of the northern station of the Regional Scheme. The Manchester studio will be used as the centre of activities for the new station.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia. — Melbourne.—State Electricity Commission. October 7th. 11,000-V three-phase cable. (B.X. 5539.)*

November 25th. Watthour meters, recording instruments, and remote metering equipment. (B.X. 5614.)*

October 1st. Posts and Telegraphs Department. Switchboard cords. (B.X. 5515.)*

October 15th. Switchboard instruments, test plugs, and sleeves. (B.X. 5541.)*

October 22nd. Telephone transformers (B.X. 5581).* Insulated wire (B.X. 5580).*

October 30th. City Council. Two 2,500-kW motor convertors and accessories or, alternatively, two 2,500-kW rotary convertors, with transformers and accessories. (B.X. 5570.)*

November 4th. 6,600-V automatic voltage regulators and spares. (B.X. 5637.)*

November 25th. Switchgear and accessories for the Yallourn Power Station. (B.X. 5636.)*

October 23rd. Victorian Railways. Dry-core telephone cable. (B.X. 5638.)*

Perth (W.A.).—November 29th. Western Australian Government. Complete boiler-house equipment, one 12,500-kW turbo-generator, and condensing plant. (August 16th.)

Sydney.—City Council. October 2nd. 6,600-V metal-clad switchgear for Argyle sub-station (spec. No. 858, 2s. 6d. each); 2,200-V ironclad switchgear for Town Hall sub-station (spec. No. 856, 2s. 6d. each); 1,500-V switchgear for Argyle sub-station (spec. No. 857, 2s. 6d. each). Chief Engineer, 61, Hunter Street, Sydney.

Belgium.—September 18th. Belgian Post and Telegraph Authorities, La Salle Madeleine, Brussels. Fifty-eight lots of miscellaneous telephone apparatus and accessories. Particulars (Cahier des Charges Special No. 3431) for 6 francs.

September 18th. Municipal Authorities of Anderlecht. Supply of three-phase static transformers. Particulars (Cahier des Charges) for 3 fr. from La Régie de l'Electricité, 6, Rue Van Lint, Anderlecht.

Bromley, Kent.—September 11th. Corporation. Electrical wiring of 63 houses on the Southborough housing site. (See this issue.)

Croydon.—September 11th. Board of Guardians. Electrical fittings and appliances for six months. Mr. N. P. Walker, clerk, Mayday Road, Thornton Heath.

Dundee.—August 13th. Education Authority. Electric lighting in connection with new primary school. Specifications, &c., from Allan & Friskin, architects, 26, Castle Street, Dundee.

Edmonton.—September 16th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk to the Guardians, 77, Bridport Road, Edmonton, N.18.

Egypt.—October 16th. Ministry of the Interior. Electric motors, pumps, mechanical filters, &c. (A.X. 8373.)*

October 2nd. Electrical power station for Dessouk (Gharbieh Province). (B.X. 5597.)*

October 1st. Supply and erection of a 500-kVA power station, with underground and overhead networks, for the town of Menouf. (B.X. 5567.)*

October 10th. Supply and erection of a generating station for Tala. (B.X. 5647.)*

India.—September 27th. South Indian Railway Co., Ltd. Electrification of suburban services. Converter equipment for sub-stations; transformer switchgear and accessories; overhead transmission line, &c. Specifications (£1) from the company's offices, 91, Petty France, Westminster, S.W.1.

October 2nd. India Store Department. 20,000 sack elements, No. 1 size. (August 30th.)

Kettering.—September 9th. Electricity Department. H.p. armoured cable. (See this issue.)

Leyton.—September 13th. Corporation. Installation of electric lighting and hot-water heating apparatus at Canterbury Road School. (August 23rd.)

Liverpool.—September 10th. Corporation. Electric lighting and power scheme for the new abattoir, Stanley. Specification from the Land Steward and Surveyor, Municipal Buildings, Liverpool.

London.—CENTRAL ELECTRICITY BOARD.—September 11th. Supply, delivery, and erection of 132-kV overhead transmission lines (approach to Clarence Dock, Liverpool). (August 2nd.)

METROPOLITAN ASYLUMS BOARD.—October 2nd. Installation of electric bells at Paddington Casual Ward; new storage battery for T.S. *Exmouth;* alterations to electric lighting installation at Eastern Fever Hospital. (August 30th.)

Louth.—September 9th. Corporation. Mains and steelwork, and outdoor and indoor sub-station equipment. (August 23rd.)

New Mills.—September 9th. Urban District Council. Electrical equipment, comprising e.h.p. and l.p. switchgear, cables, feeder pillars, &c. (August 16th.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. October 30th. Head telephone receivers. (B.X. 5603.)*

September 12th. Submarine telephone cable. (B.X. 5644.)*

Corporation. September 30th. Electric motors, starters and switchgear for the Milk Department. (B.X. 5508.)*

December 10th. Public Works Department. Three single-phase oil-insulated water-cooled transformers and accessories. (B.X. 5600.)*

October 8th. Electric ranges, radiators, and water-heaters. (B.X. 5642.)*

October 21st. City Council. H.P. and L.P. switchgear. (B.X. 5649.)*

AUCKLAND.—September 23rd. Auckland Electric Power Board. Pilot cable and joint boxes. (B.X. 5643.)*

November 4th. L.P. porcelain insulators, ironwork, &c. (B.X. 5648.)*

Oldham.—September 9th. Board of Guardians. Electric lamps required at Poor Law Institution, Rochdale Road. Specifications, &c., from Mr. F. W. Fletcher, clerk to the Guardians, Union Offices.

Portsmouth.—Electricity Department. Supply, delivery, and installation of armour-clad e.h.p. switchgear at the generating station. (August 16th.)

Reigate.—September 12th. Electricity Department. 1,800 yd. h.p. cable. (August 30th.)

Rochdale.—September 18th. Electricity Department. A.C. single-phase house service and prepayment meters for 12 months. (See this issue.)

Salford.—September 23rd. Electricity Department. One 10,000-kVA, 33-kV transformer for outdoor service at Trafford sub-station. (See this issue.)

Sleaford.—September 10th. Urban District Council. 500 yd. 4-core .5 and 500 yd. 4-core .06 armoured cable, &c. (See this issue.)

South Africa.—JOHANNESBURG.—September 30th. South African Railways and Harbours. Twelve months' supply of electric lamps. (B.X. 5590.)*

September 23rd. One 150-kW crude-oil engine-driven electric generating plant. (B.X. 5566.)*

September 26th. Two 100-kVA motor-alternator sets. (B.X. 5564.)*

October 17th. One 10-ton electrically-driven overhead travelling crane. (A.X. 8463.)*

SALISBURY.—October 17th. Municipal Council. H.p. cables, transformers, &c. (B.X. 5604.)*

Turbo-alternators, steam piping, crane and switchgear. (B.X. 5607.)*

CAPE TOWN.—October 16th. Electricity Department. Paper insulated cables. (B.X. 5640.)*

Smyrna.—Municipal Council. Construction and equipment of a modern electric bakehouse. (B.X. 5572.)*

West Ham.—September 16th. Education Committee. Installation of electric lighting and water-heating apparatus at Plaistow secondary school now in course of erection. (August 16th.)

Wolverhampton.—September 27th. West Midlands Joint Electricity Authority. Supply and erection of a double-circuit 33,000-V, 3-phase, 50-cycle overhead (steel tower) transmission line. (August 30th.)

September 26th. Education Committee. Installation of electric light and power at the Wolverhampton Grammar School. (August 30th.)

Worksop.—September 13th. Board of Guardians. Rewiring Kilton Hill Infirmary. Specifications from Mr. J. Haslam, Ryton Chambers, Bridge Street, Worksop.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Australia.—SYDNEY.—Municipal Council.

H. & l.p. switchboards and rotary convertors or, alternatively, mercury-arc rectifiers for Dalley Street sub-station, Section A (£8,472), Ferguson, Pailin, Ltd.; ditto, section B (£8,890), section C (£8,916), Metropolitan-Vickers Electrical Co., Ltd.

2,000-kVA rotary convertor or, alternatively, mercury-arc rectifier for Clarence Street sub-station (£4,475); l.p. oil switch panels (£3,563).—Metropolitan-Vickers Electrical Co., Ltd.

Harbour Trust.

Electrical materials for twelve months.—British General Electric Co., Ltd.; Australian General Electric Co., Ltd.; Lawrence & Hanson Electric Co., Ltd.; Noyes Bros (Sydney); Enfield Cable Works (Australia), Ltd.; Edison Swan Electric Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Wm. Adams & Co., Ltd.

MELBOURNE.—City Council:—

13,200 yd. fibre conduit, with jointing sleeves (£1,911).—Standard Telephones & Cables (Australia), Ltd. *Tenders.*

Blantyre.—

Installing electric lighting at a new hall for the Anderson United Free Church.—Johnstone, Park & Co. (Glasgow).

Leek.—Urban Council. Accepted:—

Overhead electricity mains to supply premises at Longsdon (£1,859).—Overheads, Ltd.

London.—ADMIRALTY.

Switch sockets, plugs and springs.—Edison Swan Electric Co., Ltd.

Southern Railway.

"Cosmos" electric lamps for 12 months.—Metro-Vick Supplies.

Salford.—Electricity Committee. Recommended:—

24,000 yards of l.p. paper-insulated lead-covered cable of varying sizes (£8,429).—Nederlandsche Kabelfabriek, Delft, Holland.

South Africa.—DURBAN.—Electricity Department:—

Two miles .04 sq. in. 6,600-V cable (£1,088).—T. Barlow and Sons, Ltd.

Three miles .06 sq. in. 11,000-V cable (£2,304).—Griffin Engineering Co., Ltd.

Five miles .075 sq. in. 3,300-V cable (£2,005), two miles .06 sq. in. ditto (£705), two miles .04 sq. in. ditto (£580).—J. M. Moir.

PORT ELIZABETH.—Electricity Department:—

Main h.p. metal-clad switchboard (£12,222), and one 4-panel e.h.p. metal-clad switchboard (£1,478).—A. Reyrolle & Co., Ltd.

42 miles of phosphor bronze 200-lb. conductor cable (£496).—British Insulated Cables, Ltd.

Electrical installation, complete with automatic telephone system, alarm bells, &c., at the new fire station (£930).—Algoa Electrical Co. *South African Engineer.*

CAPE TOWN.—Parks Committee. Accepted:—

Installation of electric cooking apparatus and water-heating plant at Muizenberg Pavilion restaurants (£520).—A. Vaux, Ltd.

Electricity Committee. Accepted:—

Ironclad service cut-outs (£510).—British Insulated Cables, Ltd.; and (£69) Siemens Bros. & Co., Ltd.

Copper wire (£2,049).—Associated Engineers Co., Ltd.; and (£115) Albert Vaux, Ltd.

97 electric light poles (£570).—British Insulated Cables (S.A.), Ltd.

Watford.—Town Council. Accepted:—

Truck type h.p. switchgear for the premises of the Electric Hose & Rubber Co., Ltd. (£514).—General Electric Co., Ltd.

Forthcoming Events.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, September 7th. South Wales Institute of Engineers, Cardiff. Chairman's address.

"Model Engineer" Exhibition.—September 7th-14th. Royal Horticultural Hall, Westminster, S.W.

Association of Public Lighting Engineers.—September 9th-12th. Bournemouth. Annual general meeting and conference.

Institute of Metals.—September 9th-12th. Dusseldorf. Autumn meeting.

Iron and Steel Institute.—September 10th-12th. North-East Coast Exhibition. Autumn meeting.

Municipal Tramways and Transport Association.—September 11th-13th. Great Yarmouth. Annual conference.

Shipping, Engineering, and Machinery Exhibition.—September 12th-28th. Olympia, W.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Quickfex Reflectors.

Notes.

An Electrical Bull.

It is alleged by the *Daily News* that the following notice appears outside a power station in Ireland:—"Warning!—To touch the wires means instant death. Anyone disregarding this warning will be prosecuted."

Electric Cooking in a City Office.

The conversion of those responsible for the efficient working of the culinary department of a large city office to the advantages of cooking by electrcity is a gratifying sign of progressive spirit in these matters. The Gresham Trust, Ltd., of Basildon House, Moorgate, operates its own kitchen in catering for the principals of the firm, whose requirements are necessarily uncertain. The number of meals required varies every day, so that considerable elasticity is called for both in the resources of the chef and the capabilities of the cooking equipment. The kitchen being situated in the basement, continuous trouble has been occasioned hitherto by the

Basildon House Kitchen.

difficulties of effectively ventilating the kitchen and its immediate surroundings, and the conditions generally under which the cooking staff have had to work were capable of some improvement. Through Messrs. Thorpe & Bosco a solution of the firm's difficulties has been found, and a complete transformation made by electrical means, of which the main feature is the installation of a "Magnet" cooker, table model de luxe D.C. 5,718, supplied by the General Electric Co., Ltd. This model has three totally enclosed hotplates, while the grilling apparatus is conveniently fitted in the capacious hot cupboard below the oven, and is removable when the hot cupboard is required for warming plates, &c. The total loading is 7.9 kW.

Institution Cooking Equipment.

The kitchen of the Woolwich Union Institution, Plumstead, has recently been equipped with electrical cooking apparatus manufactured by the General Electric Co., Ltd., and designed for coping with the catering requirements of a large number of people. For many years the equipment of these kitchens has been operated by gas and steam, and the change-over to electricity has been effected without any addition to running costs. The appliances which have replaced the older method consist of a "Magnet" double-oven range (HO. 922), each oven being of approximately 2 cu. ft. capacity. On the hob-table over the ovens there are a series of high-temperature totally-enclosed boiling plates, as well as a griller-toaster. For roasting large quantities of meat, &c., a "Magnet" cabinet-type roasting oven, with an internal cooking space of 52 in. by 53 in. by 30 in., completes the substituted equipment. In addition to the above-mentioned apparatus, the G.E.C. has also supplied a large electrical fish-fryer, consisting of three pans,

Electrical Cooking Equipment at Woolwich.

each measuring 18 in. by 18 in. by 7 in. These are mounted over a hot-cupboard in which plates, dishes, and cooked food can be kept warm, and at the back there is fitted a white enamelled splash guard, complete with suitable fish-draining racks. The fish-frying apparatus was not included in the old equipment, and, therefore, in estimating the comparative running costs of the new equipment, it would have been expected that this additional unit would have materially increased the total cost of operation. It is most gratifying, however, to note that in spite of this increase in the equipment the weekly running costs compare very favourably with those of the previous system. The handling of this new cooking plant might reasonably have occasioned some misgivings in the minds of the kitchen staff, without prior instruction in its use. The new equipment was, however, taken over and operated without a single hitch, and all concerned are most enthusiastic in their praises of electric cooking.

Hollow Conductors for 154-kV Transmission Line.

According to the *Electrical World* for August 17th, 1929, from which the accompanying table is abstracted, the Società Meridionale di Electricità, of Naples, has decided to use 154 kV as the most economical voltage for the 118-mile transmission line from Pescara to Naples. The maximum altitude reached is 3,500 ft. above sea level, and it was found that the conductor best suited to the operating conditions would be one having an outside diameter of 0.77 in. and an effective area of 0.236 sq. in. About 1,850,000 lb. of Anaconda hollow-conductor cable was required for the line. Seamless drawn-tube connectors, guaranteed to have the full mechanical strength of the cable, have been used.

Conductance equivalent H.D. copper at 20 deg. C. sq. in.	0.236
Outside diameter of cable, in.	0.770
Number of layers	1
Number of H.D. copper wires in cable	12
Diameter of H.D. copper wires, in.	0.1537
Dimensions of core, in.	0.461×0.040
Area of complete cable, sq. in.	0.2411
Weight of complete cable per 1,000 ft., lb.	974.0
Minimum breaking strength of cable, lb.	12,800
Johnson's elastic limit (average), lb.	7,680
Modulus of elasticity, lb. per sq. in.	15,000,000
Coefficient of linear expansion, per deg. F.	0.0000094

Institution of Electrical Engineers.

Students' Section Tour in Northern France.—A party of 26 students of the Institution of Electrical Engineers left London on Saturday, August 3rd, to spend ten days in visiting places of electrical interest in Paris and Northern France. The week-end was spent at Malo Terminus, and on Sunday the party went to Ostend and visited the battlefields around Nieuport.

Monday and Tuesday, August 5th and 6th, were spent in visiting the systems laid out by the Societé Bethunoise for the electrification of the rural areas around Calais and Dunkirk. After visiting the port installations at Dunkirk and a sub-station in the town, the party saw a 100,000-V step-down station of the Société Electrique du Nord-Ouest and the Diesel-

engine generating station at Coudekerque-Branche. From here the party visited Cassel, saw a step-down station at Hazebrouck, and proceeded to Bethune. The next day a visit was paid to the pulveriser plant at Gorsnay, and the headquarters of the company at Chateaux Labuissiere, returning to Bethune.

From Bethune the party proceeded to Rheims, where visits were made to the high-voltage laboratories of Verrieries Charbonneaux, Ltd., and the cellars of Messrs. Heidseick, where the party sampled the local products. From Rheims a trip was made to the battlefields around Berry au Bac.

Proceeding to Paris, the party visited the power station of the Electricité de la Seine Corporation at Ivry Port, on Thursday, August 8th. On Friday, August 9th, the party were shown over the factory of the Electro Mécanique Co. at Le Bourget, and on the same day a visit was paid to the aerodrome.

On Saturday, August 10th, the party was entertained by the International Standard Electric Corporation. The research laboratories and the experimental radio station at Versailles were visited in the morning, while the afternoon was spent in visiting the factory of the associated company, Le Matériel Téléphonique.

Visits were also made to the Eiffel Tower radio station, where telegraph and telephone plant of both ancient and modern design were inspected, and to the repair shops of the Paris-Orleans Railway at Vitry. Here the party saw electric locomotives in every stage of déshabille.

The party returned to London on Tuesday, August 13th, after a most interesting and enjoyable tour. The success of the tour was largely due to the hospitality shown to the party by all the firms whom they visited, and the trouble taken to make the visits interesting and enjoyable.

Special Illumination at Niagara.

In connection with the American celebration of "Light's Golden Jubilee," the Niagara Falls was specially illuminated in June. In Prospect Park there was a reproduction of the lighting of fifty years ago, when the waters of Niagara were first harnessed for the generation of electricity. To make the scene more realistic, a number of early carbon lamps were strung around the cliffs of the Niagara River, and lighted by the current produced by the original water-wheel generator. Suddenly, from the Canadian bank, a huge battery of twenty-four searchlights was turned on, projecting 1,440,000,000 candle-power full on the falls and converting the mighty waterfall into a gigantic cataract of molten gold. Sky drills and a "ghost dance" by the searchlights followed rapidly, and then, as the lights dropped back to the falls, coloured bombs were dropped from an airplane hidden in the darkened sky. Again the lights swung aloft, while rockets and bombs burst from the Goat Island Cliff, making the sky above and the gorge below a maelstrom of sound and scintillating light and colour.

Niagara Falls Flooded with Golden Light.

Electrical Developments in Switzerland.

The Berne correspondent of *The Times Trade and Engineering Supplement* gives some statistics in the issue for August 31st relating to electrical developments in Switzerland. He gives the following tabular statement of the total capacity of generating plant at power stations with more than 500 h.p. installed :—

Years.	Total increase in h.p.	Average annual increase in h.p.
1891-1900	121,000	12,100
1901-1910	387,000	38,700
1911-1920	620,000	62,000
1921-1928	743,000	92,900

Plant to the extent of 478,000 h.p. was in course of construction at the end of last year, and it is anticipated that the average *annual* increase for the period 1921-1930 will work out at approximately 122,000 h.p. Work is proceeding on eight power stations, which, when completed, will bring the total rating of the installed plant in the country to 2,620,000 h.p. Schemes are being elaborated for the erection of further power stations in the near future, the rating of which is put at some 730,000 h.p.

At the end of 1928 the rating of the installed plant totalled 2,142,000 h.p., distributed as follows :—

		Per cent.
Private companies	847,000 h.p.	= 40
Municipal undertakings	198,000 h.p.	= 9
Cantonal and semi-State undertakings	782,000 h.p.	= 36
Federal Railways	315,000 h.p.	= 15

During 1928 Swiss electric power works produced approximately 5,300,000,000 kWh, against 1,700,000,000 in 1913. A marked increase was recorded last year in the utilisation of the total possible output, 85-88 per cent. of the available power having been absorbed by consumers. This increase was due principally to closer co-operation between producers, the more rational utilisation of surplus night power, and larger exports. The consumption of electric power in 1928 was distributed as follows (millions of kWh) :—

Lighting, power and heating	1,700
Supplied to large electro-chemical and metallurgical undertakings	1,200
Exports	1,034
Railway traction	610
Chemical and metallurgical industries and thermal applications in special industries	560
Small private power producers	200
Total	5,304

The consumption represented an average of 1,070 kWh per head of the entire population, compared with 907 kWh in 1927, exports being excluded in both cases.

Second World Power Conference.

The second World Power Conference is to be held in Berlin from June 16th to June 25th, 1930. The attendances at the first plenary meeting (Wembley, 1924) and the interim sectional meetings included not only engineers, but statesmen, economists, and others interested in the effects of engineering progress on the structure of society as a whole. In 1924 the conference was representative of 47 countries. It is not desired that the conference shall encroach upon the activities of other organisations, but rather that it shall provide an opportunity for clearly visualising the general problems and formulating them, with a view to their being taken in hand and carried to a conclusion by specialist institutions. Papers to be read at the conference (which can be submitted only through national committees) fall under 12 heads :—Solid, liquid, and gaseous fuels, steam-power, internal-combustion engines, water-power, mechanical transmission of power, electricity, legislation, standardisation, education, statistics.

Diesel-Electric Locomotive's Non-Stop Run.

We learn from *The Times Trade and Engineering Supplement* for August 31st, 1929, that a remarkable non-stop run has been made by a Diesel-electric locomotive on the Buenos Ayres Great Southern Railway. The train was composed of the locomotive (weight 62 metric tons), a first-class family coach (30.7 tons), and an official coach (63.8 tons), having a total weight of 159 tons, including passengers and the

extra oil and equipment carried for the trip. Leaving Plaza Constitución, the terminal station at Buenos Ayres, at 11.8 on the night of July 6th, it ran without a stop, though slowing down at most of the stations to pick up the signal staff, to Cipolletti, which was reached at 7.45 the following evening. The distance of 1,240 km. (about 775 miles) was thus traversed in 20 hours 37 minutes at an average speed of 60.1 km. an hour.

The maximum speed recognised for this Diesel-electric unit is 75 km. an hour, the locomotive being fitted with a Teloc time and speed recorder arranged for this maximum speed. On several occasions during the journey this maximum was reached, and at one period it was maintained for a distance of 73 km.

The power plant on the locomotive consisted of a Beardmore eight-cylinder four-cycle Diesel engine giving 375 b.h.p. at 700 r.p.m. directly coupled to a Metropolitan-Vickers 300-kW compound-wound direct-current generator. The fuel consumption during the trip was 2,174 lb. of oil, having a calorific value of about 19,000 B.Th.U., or at the rate of 0.011 lb. per ton kilometre.

Appointments Vacant.

Switchboard attendant for the Betteshanger Colliery Power House. Assistant engineer for the Government of Iraq Posts and Telegraph Department (Rs. 800 per month). Electrical Engineer (£400) for the Borough of Newark Electricity Department. Meter superintendent (£500-£600) for the Perak River Hydro-Electric Power Co., Ltd. (See our advertisement pages to-day.)

Electric Steel Melting in Europe.

Casting steel ingots at an electricity consumption of 210 kWh per ton, with an arc furnace charged with liquid metal, is shown in the accompanying table of electric furnace characteristics and operating data. These ten furnaces are

ELECTRIC STEEL MAKING IN EUROPE*

No. furnaces in plant...	4	2	1	1	1	1
Type of furnace ...	Arc	Arc	Arc	Arc	Induc.	Induc.
Capacity in kVA ...	2,675	1,250	1,800	3,500	350	670
Primary voltage ...	—	—	5,000	5,000	5,000	5,000
Secondary voltage ...	130	125	133-119-107	146-128-107	130 V-1,800A	10
Type of electrode ...	G.	G.	G.	G.	—	—
Type of lining... ...	B.	A.	B.	B.	A.	B.
Hours operating-day ...	—	—	Cont.	Cont.	15	Cont.
Type of charge ...	S.C.	S.C.	L.C.	L.C.	S.C.	S.C.
Type of casting ...	I	C	I	I	C	I
Tons-Mo., furnace ...	1,800	650	1,800	2,800	82	500
No. charges-Mo. ...	90	160	200	200	103	85
Average tons, charge...	20	4-4.5	10	15	18	6.5-6.5
Kilowatt-hour, ton ...	680	725	250	210	865	605
Kg. electrode, ton ...	4.5	5.5	2.5	2.5	—	—
Heats, side wall ...	75	170	1,000	1,000	1,250	—
Heats, roof	75	170	45-90	45-90	150	200
Time, charging, hours	6.5-8	—	2.5	2.5	3.5	8

A-acid; C-castings; I-ingots; S.C.-solid charge; B-basic; G-graphite; L.C.-liquid charge.

*From Western Society of Engineers Hunt Award Paper for 1929 by Delton T. Waby.

located in Germany and Italy. The information in the table indicates a general parity of development in the art in Europe with progress in United States.—*Electrical World*, August 17th, 1929.

Educational.

POLYTECHNIC, REGENT STREET, W.1. SCHOOL OF ELECTRICAL ENGINEERING.—Session 1929-30.—The new session commences on September 23rd. Enrolments from September 16th-20th. Courses will be held in Electrical Engineering, Telephony and Telegraphy, Wireless and High-frequency Engineering. Full particulars and prospectuses can be obtained from the Director of Education. Courses of 24 lectures on Electrical Technology, by Mr. P. Kemp and Mr. H. P. Young, will be given on Mondays, commencing September 23rd, from 6.30 to 7.30 p.m. and from 7.30 to 8.30 p.m.

LONDON COUNTY COUNCIL SCHOOL OF ENGINEERING AND NAVIGATION, Electrical Engineering and Physics Department.—Major and minor courses in electrical engineering, electrical installations, telephony, &c., will commence on Monday, September 23rd; enrolment during week commencing September 16th. Prospectus and full particulars can be obtained on application to the secretary at the school.

NORTHAMPTON POLYTECHNIC INSTITUTE, Clerkenwell, E.C.1.—Courses in fuel technology for combustion and power-house engineers.—These courses comprise lectures dealing with the chemistry of combustion and the calculation of thermal efficiencies of furnaces. Session commences September 23rd, and enrolments commence on September 16th. Free particulars on application to the Institute. Evening classes in electrical engineering will commence on September 23rd. (See our advertisement pages to-day.)

UNIVERSITY OF MANCHESTER, FACULTY OF TECHNOLOGY.—The Michaelmas term will commence on October 3rd; enrolment of students will take place from September 30th to October 2nd.

Legal.

SPURIOUS "OSRAM" LAMPS.—At the Hull Police Court on August 26th, Henry Tattersall, trading as the Thornton Trading Co., Thornton-le-Fylde, near Blackpool, appeared upon four summonses under the Merchandise Marks Act, 1887, in connection with the sale of electric lamps. He pleaded not guilty.

Mr. L. A. BYRNE, who appeared for the prosecutors, the General Electric Co., Ltd., stated that his clients had the sole right to use the trade mark "Osram" in this country. The defendant had sold to a firm of electrical contractors in Hull some spurious lamps which were in cartons printed with the words "Osram—made in Italy." "Osram" lamps of the General Electric Co., Ltd., were made at the company's factory at Hammersmith, London.

Evidence was given which showed that the defendant supplied a half-dozen of such spurious lamps in cartons wrongfully marked with the "Osram" trade mark, and that he had offered to supply further such lamps, and if need be to stamp the lamps themselves with the word "Osram." A factory superintendent at the Osram Hammersmith Lamp Works gave evidence to the effect that the lamps in question were not made at that works, and were, in fact, spurious lamps. Evidence was also given by an expert from a German company, who owned the mark "Osram" in Italy, that these lamps had not been made by his firm.

The defendant said that his address was 22, Cross Street, Blackpool, and that he was a commission agent receiving 50 per cent. commission on the cost price from a man of the name of William Graham, trading as the Thornton Trading Co., Thornton-le-Fylde, near Blackpool, and that he, the defendant, knew nothing about the lamps not being genuine "Osrams," as he was only concerned with selling them. He said he had been in the electrical business about six years. It was stated in court that the defendant had previously been associated with the sale of lamps bearing an infringement of the "Osram" trade mark.

The Stipendiary found the defendant "guilty" on all four summonses, and imposed a fine of £10 and £10 10s. costs on the first two summonses, or, in the alternative, 51 days' imprisonment, and a further £10 and £10 10s. costs or 51 days' imprisonment on the remaining summonses. He said that if the defendant did not pay the fines and costs the terms of imprisonment were to run consecutively and not concurrently.

The defendant asked for time to obtain the money, but this was refused.

Association of Mining Electrical Engineers (South Wales Branch).

The first general meeting of the Session, 1929-30, will be held at the South Wales Institute of Engineers, Cardiff, on September 7th, when Mr. W. W. Hannah will deliver his address. During the session the following papers of electrical interest will be read:—

November 16th: "Electrical Measuring Instruments," Mr. R. H. Morgan.

December 14th: "Mining Cables," Mr. W. T. Anderson.

February 15th, 1930: "Safety and Efficiency in Mines," Mr. W. A. Hutchings.

The annual dinner will take place at Cardiff on January 18th.

Western Sub-Branch, Session 1929-30; the following are among the papers to be read:—

October 12th: Chairman's address.

November 9th: "The Problem of Peak Loads," Mr. G. E. Hider.

December 14th: "Electricity in Mines—First Aid," Dr. Stanley Phillips.

January 11th, 1930: "Some Considerations *re* Power Cost," Mr. S. T. Richards.

February 8th: Paper by Mr. J. A. B. Horsley.

March 29th: Discussion on H.M. Electrical Inspector's Report for 1928.

April 12th: Annual dinner.

Comparison of Results of Tests on Four Types of Carbonising Equipment.

During 1925-27 tests were made on four types of coal carbonising equipment, namely, by-product coke ovens, horizontal through retorts, intermittent vertical retorts, and continuous vertical retorts. Coal from the same mine was used in all tests.

Only in the case of the continuous vertical retorts, which were steamed to the extent of 12 per cent., is there any great difference in the results. The continuous vertical retorts, partly because they are steamed, and partly because of their construction, produce more gas and tar, less ammonia, and are more economical of heat.

	Coke ovens.	Horizontal retorts.	Intermittent vertical retorts.	Continuous vertical retorts.
Cu. ft. of gas per lb. of coal	5.66	6.06	5.67	7.15
B.Th.U. in gas per lb. of coal	3,245	3,280	3,065	3,790
Gallons dry tar per ton dry coal	12.4	11.6	11.4	14.6
Coke yield as per cent. of coal carbonised	70.2	68.6	70.7	70.0
Heat of combustion of coke, gas, and tar, as percentage of heat combustion of coal	92.9	92.6	92.9	98.3
Lb. of ammonia per ton coal	6.36	4.92	5.94	3.38
B.th.u for carbonisation per lb. coal	1,320	1,420	1,485	985

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. J. TREVOR JONES, mains assistant engineer with the Manchester Corporation, has been appointed electrical engineer and manager by the Gellygaer Urban Council.

Mr. J. H. WHITEHEAD, for several years lecturer in engineering science at Bacup and Rawtenstall Technical School, is taking up the duties of lecturer in electrical engineering at the Constantine Technical College, Middlesbrough. For six years he has been a transformer engineer with Messrs. Ferranti, Ltd., Hollinwood, and has been a part-time demonstrator and instructor at Manchester College of Technology.

At a meeting of the Council of the Tramways and Light Railways' Association, held on July 26th, Mr. E. H. EDWARDES, general manager of the South Lancashire Tramways Co., was unanimously elected chairman of the Council, for a term of three years. At the same meeting Mr. C. J. SPENCER, late chairman of the Council, and Mr. G. H. MARGROVE, general manager of the Yorkshire (West Riding) Electric Tramways Co., Ltd., were appointed members of the Council.

The marriage took place at Chelmsford, on August 26th, of Mr. HERBERT NEWMAN PULLEN, of the staff of Marconi's Wireless Telegraph Co., Ltd., and Miss N. K. ARCHER. The bridegroom received from his colleagues a canteen of cutlery.

Mr. ERNEST STANLEY GILRONAN, of the staff of W. T. Henley's Telegraph Works, Ltd., of North Woolwich, who was married last week to Miss V. B. CHAPMAN, was presented by his colleagues with a canteen of cutlery. His bride, who has been with Siemens Bros., Ltd., of Woolwich, received an oxidised silver mirror from her fellow employés.

There were ninety applications for the post of borough electrician at Richmond, Yorks., rendered vacant by the resignation of Mr. W. L. Wickwar, who has received an appointment at Bingley. Mr. J. B. HOOD, who was appointed, is at present in the service of the South Shields Electricity Department.

Mr. H. P. STOKES, engineer and manager of the Plymouth tramway and omnibus system, has been appointed general manager and engineer of the British United Automobile Services, Ltd., London, at £2,000 a year. Mr. Stokes will have York as his headquarters.

The wedding was solemnised at Burnley, on August 29th, of Mr. THOMAS GILL, B.Sc., and Miss MAMIE HEYES, only daughter of Chief Inspector Heyes, of Burnley Tramways Department. The bridegroom is on the staff of the Metropolitan-Vickers Electrical Co., Manchester.

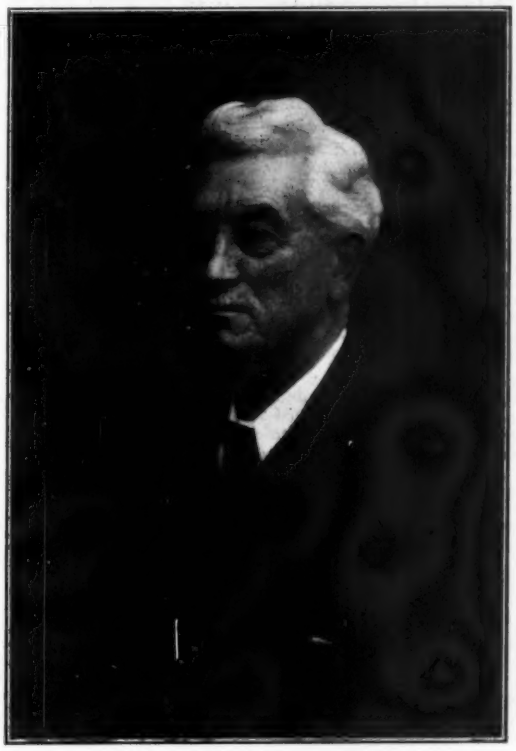
A Newcastle paper says that Lieut.-Colonel NORMAN H. FIRMIN is shortly leaving the Newcastle-on-Tyne Electric Supply Co., with which he has been engaged for 24 years—the last ten being spent as personal assistant to Mr. R. P. Sloan, the chairman and managing director—and is coming South to take up an appointment with the Central Electricity Board in London.

Mr. A. E. JEPSON, M.I.E.E., &c., is leaving the post of manager of the Sheffield branch of the General Electric Co., Ltd., after ten years' duty there, to take up a position at Manchester for the company, of which, according to a Sheffield paper, he has been appointed deputy assistant manager. Mr. Jepson's successor in Sheffield is Mr. A. J. CHEYNE, manager of the company's Hull branch.

At the Tramways Committee of the Sheffield Corporation it was reported that Mr. W. H. HOYLAND, general assistant in the tramways department, had been successful in obtaining first place in the competition organised by the Municipal Tramways and Transport Association, with his essay on the subject: "What do we owe the passenger for his fare?" and that he would be entitled to a silver medal and a cheque for £15.

We regret to learn from American dispatches to the Press that Mr. T. A. EDISON has been ill in bed for the past twelve days. One report says he has had a "cold," another pneumonia, and a third that a brain specialist has been called in.

Obituary. — MR. HENRY SCHIASSI.—As we recorded in our last issue, Mr. Henry Schiassi passed away on August 20th last. For upwards of 34 years Mr. Schiassi was an engineer on the staff of Callender's Cable and Construction Co., Ltd., and was associated with some of the earliest cable laying operations in the City of London and elsewhere. Owing to failing health he retired from active work a few years ago and took up his residence at Vevey, Lake Geneva, where his remains are laid to rest at the English Church. Henry Schiassi, or "H. S." as he was familiarly called by his more intimate associates, was of a happy disposition, and his hearty good fellowship endeared him to all who came in contact with him. Although bearing an Italian name, his mother was English, and, his father dying when he was of tender years, he was brought up in England. For a time he was a boarder at a school in France, but, finding the conditions not to his liking, he took an early opportunity of releasing himself, and ran away to sea. After a period on a large cattle station in Queensland, he returned to the sea and later married and settled down in England. For a time he carried out experimental work in the laboratory of the School of Electrical Engineering in Hanover Square, under the direction of the late Desmond Gerald Fitzgerald. At this time he was also associated with Mr. C. H. W. Biggs (then editor of the *Electrician*), Mr. W. W. Beaumont, and Mr. H. D. Wilkinson. He joined Callender's in 1888 and at once attracted the attention of the managing director, Mr. Tom Callender (now Sir Thomas), and soon stood out as a leading figure in connection with many notable cable laying undertakings both in London and the provinces. He became at one time a notable figure at Windsor and Buckingham Palace when cable laying was being carried out at the Royal



The late Mr. Henry Schiassi.

residences. In more recent times he was engaged, during the war, in some cable laying work, upon which he organised gangs of German prisoners. He was a keen sportsman, and in the days of the Volunteer system he was a member of the London Rifle Brigade. His wife predeceased him by a few years. He leaves two daughters, who nursed him devotedly in his last illness, and a son, who is married and settled in Canada. His memory will be cherished by a large circle of friends and acquaintances.

Mr. J. HALLAM.—The death has taken place of Mr. John Hallam, partner in the firm of J. E. Hallam & Sons, general electrical engineers, of Great Portland Street, Stockport. He was in his twenty-third year.

Mr. R. A. MORRISON.—The death occurred recently, at the age of 53 years, of Mr. Robert Alexander Morrison, secretary and director of Stewart & Lloyds, Ltd., Glasgow.

MR. R. M. LOWNE. — We regret to record that the death occurred on August 17th at his residence at 16, Southend Lane, Catford, S.E., of Mr. Robert Mann Lowne, who was the inventor of many scientific and meteorological instruments the Lowne electric clocks, the electrical wind vane, the spirometer, and the portable air meter which is in universal use in coal mines. He was 85 years of age.

MR. C. H. MCCARTHY JONES.—The *Daily Telegraph* reported last week the death of Mr. C. H. McCarthy Jones, managing director of the Indian Radio Telegraph Company, in Bombay, of enteric fever. Our contemporary says that Mr. Jones, who developed the "beam" radio system to a high state of efficiency in India, was assistant engineer on the reconstruction of the City and South London Electric Railway, manager in Calcutta of the Indian branch of the British Thomson-Houston Co., and consulting engineer to the Burmah Oil Company. In the last-named capacity he carried out important schemes in oilfields electrification.

Mr. A. E. WRAY.—The death occurred at sea on July 20th of Mr. A. E. Wray, for many years a member of the Tramways and Light Railways' Association. During the past few years he had represented the Foundation Co., Ltd., in whose service he was engaged at Melbourne, Australia.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Portable Electroplater, Ltd.—Private company. Registered August 26th. Capital, £7,000 in 50,000 "A" shares of 2s. each and 25,000 "B" shares of 2s. each. Objects: To acquire from the Brakspar Syndicate, Ltd., the benefit of a certain existing invention relating to electro-plating apparatus, and to carry on the business of electro-platers in all its branches, and that of mechanical engineers, metal workers, enamellers, electrical engineers, &c. The subscribers (each with one share) are: W. H. Waltord, 10, Lambourne Road, Leytonstone, E.11, clerk; A. E. Gilbert, 32, Clacton Road, East Ham, E.6, clerk. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

Calamco, Ltd.—Private company. Registered August 26th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, merchants and factors of electrical goods, etc. The directors are: H. A. Lewtas, 5, Sandy Lane, Stretford, near Manchester; G. A. Jones, Clairmont, Gledhow Lane, Chapel Allerton, Leeds, woollen merchant. Secretary: H. Brining. Registered office: 7, East Parade, Leeds.

Whitehurst Magneto and Dynamo Works, Ltd.—Private company. Registered August 24th. Capital, £750 in £1 shares. Objects: To adopt an agreement with Lilian M. Whitehurst, and to carry on the business of manufacturers of and dealers in magnetos and dynamos, and all electrical equipment and accessories, wireless apparatus, general, motor, electrical and other engineers, &c. The directors are: Lilian M. Whitehurst, 686, London Road, Westcliff-on-Sea, magneto repairer (permanent); R. G. Pursord, "Ladywood," Gravel Road, Eastwood, Essex, magneto repairer. Registered office: 307, London Road, Westcliff-on-Sea.

J. G. Sneath, Ltd.—Private company. Registered August 28th. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrical engineer carried on by J. G. Sneath at Limehouse. The directors are:—J. G. Sneath, electrical engineer, chairman; and Mrs. C. S. Sneath, 90, Westborough Road, Westcliff-on-Sea. Registered office: 5, Wallwood Street, Limehouse.

Ellison Manufacturing Co., Ltd.—Private company. Registered August 29th. Capital, £3,000 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in wires, lamps, fittings, accumulators, batteries, dynamos, motors, switches, controls, valves, telephonic and telegraphic instruments, wireless goods and accessories, electrical, mechanical, wireless and general engineers, &c. The subscribers are:—Mrs. P. Ellison, "Brooklands," Follifoot, Harrogate; M. C. Ellison, "Brooklands," Follifoot, Harrogate. M. C. Ellison is to be permanent governing director and chairman whilst holding 50 shares. Solicitors: Titley and Paver-Crow, 6, Princes Square, Harrogate.

Naturetone, Ltd.—Private company. Registered August 27th. Capital, £10,000 in 9,970 5 per cent. cumulative preference shares of £1 each and 600 ordinary shares of 1s. each. Objects:—To adopt an agreement with M. A. Cowan, Ltd., M. A. Cowan, G. V. Palmer, G. Hope, and R. Wilson, to acquire the benefit of inventions connected with improvements in volume and tone control systems in electrical sound reproduction, and to carry on the business of manufacturers of and dealers in cinematographs with or without concurrent sound record or projection, talking and sound-reproducing machines, &c. The directors are:—M. A. Cowan, 12, Anson Road, Cricklewood, N.W.2, theatre director; G. Hope, 33, Cambridge Street, Hyde Park, W.2, theatre producer; G. V. Palmer, 14, Ridgemount Gardens, W.C.1, theatrical manager. Registered office: Imperial House, 80, Regent Street, W.1.

Walsall Hardware Manufacturing Co., Ltd.—Private company. Registered September 2nd. Capital, £200 in £1 shares. Objects:—To carry on the business of manufacturing, electrical engineers and machinists, malleable and grey iron-founders, manufacturers of gunmetal, brass, and nickel silver castings, iron and steel tubes, gas, steam, and water fittings, &c. The permanent directors are:—Mrs. Jane E. Franks, "The Lawn," Thornhill Road, Streetley; Mrs. Millicent Purchas, "Clevedale," Steyning, Sussex; A. E. Read (managing director), "Oakdale," Streetley, Staffs.

Official Returns of Electrical Companies.

Atlas Carbon and Battery Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated July 30th, 1929, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Electrolumination (Abady Process), Ltd.—Particulars filed of £2,000 debentures authorised August 2nd, 1929, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000

Dorian Wireless Co., Ltd.—Debenture dated August 16th, 1929, to secure £2,100, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. Lumley, 39, Lombard Street, E.C.3.

International Electric Co., Ltd.—Capital, £51,000 in £1 shares (20,000 preference and 31,000 ordinary). Return dated June 18th, 1929. 30,100 ordinary and 5,822 preference shares taken up. £32,922 paid on 27,100 ordinary and 5,822 preference shares. £3,000 considered as paid on 3,000 ordinary shares. Mortgages and charges, £70,500.

Erskine, Heap & Co., Ltd.—Return dated April 4th, 1929. Capital at date of return, £25,000 in 10s. shares (increased to £50,000 in 10s. shares in May, 1929). 45,489 shares taken up. £3,913 paid on 7,826 shares. £18,831 10s. considered as paid on 37,663 shares. Mortgages and charges, nil. Return of allotments, made up May 2nd, 1929, shows a further 1,000 shares payable in cash and fully called up.

Paignton Electric Light and Power Co., Ltd.—Capital, £50,000 in £1 shares. All shares issued and fully called up to May 22nd, 1929. Mortgages and charges, nil.

Ericsson Telephones, Ltd.—Capital, £500,000 in £1 shares (199,970 preference and 300,030 ordinary). Return dated April 17th, 1929. All shares taken up. £269,980 paid, being £1 on 50,010 ordinary, £1 on all the preference, and 8s. per share on 50,000 ordinary shares. £230,020 considered as paid, being £1 on 200,020 ordinary and 12s. per share on 50,000 ordinary shares. Mortgages and charges, £100,000.

Weldrics (1922), Ltd.—Capital, £25,000 in £1 shares. Return dated March 20th, 1929. 15,500 shares taken up. £13,925 paid on 14,000 shares (£75 calls unpaid). £1,500 considered as paid on 1,500 shares. Mortgages and charges, nil.

W. T. Glover & Co., Ltd.—Capital, £214,850 in £1 shares (100,000 preference and 114,850 ordinary). Return dated June 4th, 1929. All shares taken up. £117,000 paid and £97,850 considered as paid. Mortgages and charges, nil.

Bournemouth and Poole Electricity Supply Co., Ltd.—Capital, £1,300,000 in £1 shares (75,000 4½ per cent. cumulative preference, 175,000 6 per cent. cumulative preference, 150,000 new preference, 760,000 ordinary and 140,000 shares). Return dated May 17th, 1929. 75,000 4½ per cent. preference, 175,000 6 per cent. preference, and 720,000 ordinary shares taken up. £550,000 paid on the preference and 300,000 ordinary shares. £420,000 considered as paid on 420,000 ordinary. Mortgages and charges, £187,500.

Costa Rica Electric Light and Traction Co., Ltd.—Capital, £130,000 in £1 shares. Return dated April 4th, 1929. All shares taken up. £7 paid and £129,993 considered as paid. Mortgages and charges, £272,700.

British Hanovia Quartz Lamp Co., Ltd.—Capital, £25,000 in £1 shares. Return dated May 7th, 1929. All shares taken up. £20,500 paid and £4,500 considered as paid. Mortgages and charges, nil.

Folkestone Electricity Supply Co., Ltd.—Capital £237,500 in £1 shares (175,000 ordinary, 50,000 preference, and 125,000 employés'. Return dated April 5th, 1929. All shares taken up. £200,000 paid on 140,000 ordinary, 50,000 preference, and 10,000 employés'. £37,500 considered as paid on 35,000 ordinary and 2,500 employés'. Mortgages and charges, £99,100.

Bath Electric Tramways, Ltd.—Capital £230,000 in 75,000 preference, 125,000 preferred ordinary, and 30,000 deferred ordinary shares of £1 each. Return dated April 29th (filed July 3rd), 1929. 75,000 preference, 75,606 preferred ordinary, and 30,000 deferred ordinary shares taken up. £150,606 paid. £30,000 considered as paid. Mortgages and charges: £110,478.

Banbury and District Electric Supply Co., Ltd.—Satisfaction in full on July 24th, 1929, of debentures dated March 26th and June 25th, 1913, and March 2nd, 1915, securing £4,500.

Castellina Company (1926), Ltd.—Mortgage debenture dated July 26th, 1929, to secure £500, charged on the company's undertaking and property, present and future. Holder: H. W. Pratt, 102, Charing Cross Road, W.C.

Bayliss, March and Newey, Ltd.—W. F. Bridgewater, 3, Cherry Street, Birmingham, was appointed receiver and manager on August 16th, 1929, under powers contained in debenture dated July 12th, 1927.

South Metropolitan Electric Light and Power Co., Ltd.—Capital, £1,100,000 in 850,000 ordinary, 150,000 first preference, and 100,000 second preference shares of £1 each. Return dated April 30th (filed July 23rd), 1929. 600,000 ordinary, 150,000 first preference and 100,000 second preference shares taken up. £492,132 paid on 247,500 ordinary, 144,632 first preference, and 100,000 second preference shares. £357,868 considered as paid on 352,500 ordinary and 5,368 first preference shares. Mortgages and charges: £374,090.

City Notes.

Stock Exchange Notices.

Application has been made to the Committee to allow the following to be officially quoted:—

West Gloucester Power Co.—£85,000 six and a-half per cent. participating preference stock.

The undermentioned have been ordered to be officially quoted:—

Underground Electric Railways Co. of London, Ltd.—12,108 ordinary shares of £1 each, fully paid, Nos. 7,207,074 to 7,219,181.

Electramonic Co., Ltd.

The *Financial News* states that this company's factory at Southwark has been purchased for £38,000 by Celestion, Ltd. The latter company will continue to produce Electramonic radio and gramophone apparatus, while the Electramonic Co. will confine its activities to the sale of this apparatus. It is further stated that the directors of the company have under consideration a reconstruction scheme which they intend to place before the shareholders at an early date.

Pettigrew & Merriman (1925), Ltd.

According to the *Financial Times*, the accounts covering the period of nineteen months ended July 31st last show a loss of £26,482, after the writing-down of stock, &c. A further amount of £44,297 has been written off, mainly in connection with the company's interests in foreign subsidiaries. Thus the deficit of £13,102 brought forward is raised to £80,598.

Rangoon Electric Tramways and Supply Co., Ltd.

An interim dividend of 8 annas per share has been declared on the ordinary shares, as last year.

Radio Corporation of America.

The accounts for the quarter ended June 30th last show a total gross income of $28,796,766. After deducting operating and administrative expenses, &c., there is a surplus profit of $1,409,299, making $4,996,487 for the first half of the current year.

Brazilian Traction, Light and Power Co.

A quarterly dividend of 1½ per cent. has been declared on the outstanding cumulative preference shares.

Clarke, Chapman & Co., Ltd.

An interim dividend of 3 per cent. has been declared on the ordinary shares, as last year.

Adelaide Electric Supply Co., Ltd.

The company is offering to its share and debenture holders (in the first place) £250,000 of 6 per cent. "D" consolidated stock at par. The offer remains open until September 24th.

Stocks and Shares.

TUESDAY EVENING.

IF the present week should pass without alteration being made in the Bank Rate, the prophets will only place their predictions a little further ahead, and will continue to look for a rise unless the monetary situation should rapidly change. This is a possibility always on the cards, so to speak, there being as many glorious uncertainties in Lombard Street as there are in cricket. The shadow of dear money is one that casts its cloud over Stock Exchange prices, over trade and industry, over interests covering wide areas. The anomaly persists to which attention was drawn here last week; namely, that while the high money-rates were initiated by America, partly as a consequence of American speculation in stocks and shares, the prices of the popular American Utility issues have bounded ahead, as though regardless of the normally restraining power of dear money. The latter causes dulness, amounting to depression, amongst British gilt-edged stocks, but speculative American shares continue to soar.

Dollar Stocks.

Amongst these Canadian-American-Mexican Utilities, International Telephone and Telegraph, at 150, is 2 higher, after its last week's jump of 25 points. Canadian General Electrics, which had gone up 45 in two days, hold their ground at 400. Montreal Light and Power has put on 6½, to 154½. Hydro-Electrics have come straight up from 71 to 81 in a fortnight. Brazilian Traction preferred are 25 higher on the week, at 235, and the Common, at 73, show an advance of 2. American Telephone and Telegraph fell back 2, to 30. Power Corporation of Canada, at 137½, is ex the share bonus, while Shawinigan Water, at 112, is 1 to the good. Movements on the scale of those which have been taking place during the past four or five weeks, are not always the result of any large volume of business. In such shares as Hydro-Electrics and Brazilian Tractions, the turnover has been enormous, but Canadian Generals, to take another example, can move half a score of points without any shares at all changing hands in London. The American quotation from New York or Montreal can set a pace which London follows by the simple process of making a price up or down to bring it into approximate correspondence with the price from overseas. Brazilian Tractions went unperturbed by Canadian denial of the rumour that an American group was negotiating for control of the company. International Holdings dipped to 13, and rallied to 13½. Electric Shareholdings, a recent introduction to London, are quoted at 59.

British Electricity Supply.

County of London Electric ordinary shares have demonstrated their virility by adding half-a-crown to their price, raising the latter to 57s. 6d. The shares have been extensively bought, and report says that the new issue is near at hand. September is the month when, the holidays nearly over, applicants for fresh capital start to sharpen their pencils. The Bank Rate offers, however, a bar to enterprise of this kind. Brompton ordinary have risen more than the dividend deduction made from the price last Thursday. Metropolitan Electrics proved to be in short supply when a few buyers endeavoured to pick up the shares, the price of which thereupon hardened to 2½. North Metropolitan Electrics are better at 52s. Urban ordinary, at 38s. 3d., are 1/16 up. Provincial electricity supply shares are mostly a little firmer than they were, Midland Counties rising to 34s. 6d., Yorkshires to 36s. 6d., Lancashires to 28s. 6d. Scottish Power are better at 31s. 6d. Folkestones keep good at 53s. 6d. Egham and Staines rallied to 37s., and Bournemouths retain their last week's advance to 68s. 9d. Clyde Valley ordinary, at 36s. 3d., are unaffected by the interim dividend of 3 per cent. on the "old" shares. The new shares, now fully paid, and quoted at 34s. 9d. premium, will receive a dividend in six months' time. Oxford Electric ordinary, rarely dealt in, are 27s. 6d. British Light and Power are a dull market at 17s. 9d.

Home Railways Hesitate.

After a run of nearly ten days' buoyancy, the Home Railway market fell upon reaction. Metropolitan Consolidated touched 61 before easing off to 59½. Underground Electric Incomes dropped back to 111 ex the £3 dividend, and the £1 shares declined to 23s. 6d. Deduction of the half-yearly dividend left Central London ordinary at 71 ex. Districts have not moved from 71½ for a fortnight. British Electric Traction deferred stock changed hands down to 1,600: the present price is 1,650 buyers. The London group of tramways exhibits little movement. London United Tramways preference have been recently negotiated at 5s. 4½d., London and Suburban ordinary at 2s. 6d. and 2s. 9d., and the preference at 9s. 6d. Amongst the foreign shares, Lisbon Electric Trams are tolerably active, at the increased price of 22s. 6d. La Plata Trams were last done at 2s. 3d.

Indian and Foreign.

Indian and other Eastern shares are attracting attention, more by way of inquiry, however, than by any particular accession of business. Delhi Electric Supply ordinary are 21s. 8d., Cawnpore 32s. 6d., Calcutta 54s. 6d., Madras 31s. 3d. Burma Electric Supply ordinary are 17s. 6d., and the 6 per cent. preference 18s. 9d. Perak Hydro-Electric came into demand up to 16s. Outside the Eastern division, Victoria Falls reacted a trifle to 64s. 4½d. East African Light and Power ordinary are 30s. Atlas Light and Power hold their previous position, at 29s. Projected new issues under consideration amongst electric supply and traction companies are said to be held up, pending Bank Rate announcements, although these are not likely to interfere with offers of shares at bonus prices to holders of investment securities. Central Electricity Board 4 per cent. 1959-89 scrip, which came out at 83, can be bought at 3 discount or less. A "broken" interest payment of 1 per cent. is due on November 1st next.

Preference Shares.

A wider selection than usual of preference shares is now available in the various electrical sections. This is due to the present monetary conditions that obtain. A thousand British Thomson-Houston 7 per cent. preference are on offer at 23s., June and December dividends, yielding £6 1s. 9d. per cent. on the money, and well-secured as to dividend according to the last-published figures. Crompton-Parkinson 8 per cent. first preference at 26s. 6d. give £6 0s. 9d., and the company's 6 per cent. second preference at 17s. 9d. pay 6¾ per cent., both carrying dividend due at the end of this month. Edmundson's 7 per cent. preference at 24s. 6d., January and July, yield 5¾ per cent.; Hendon 6 per cent. preference at 22s. 3d., May and November, £5 8s. per cent.; Mersey Power 6 per cent. preference, at the same price, give the same yield, but with June and December dividend; Charing Cross 4½ per cent. preference, June and December, at 17s. 9d., £5 2s. 9d. per cent. In all these cases there are 1,000 or more shares obtainable in the market. Newcastle-upon-Tyne Electric 5 per cent. non-cumulative preference at 20s. 6d., and offering £4 17s. 6d. per cent. on the money, are entitled to additional dividend after the ordinary receive 8 per cent. When this happens, the preference stand to receive a further 3 per cent., and thereafter both shares rank equally. For 1928, the ordinary received 6 per cent.

Cables and Wireless.

Flatness in the B ordinary stock is the principal feature of the Cables and Wireless trio. The price dropped from 72 to 64 before any kind of recovery occurred. The presence of a few buyers caused a rally to 66, but the market is what the Stock Exchange calls very tender. The A ordinary stock is none too happy at 82½; some of the sellers have taken down to 81 for it. Eastern Telegraph ordinary, in its present equivalents of Cables and Wireless stocks, stands at 258½, which is about 20 points lower than the price quoted on the eve of the books closing for the stock to be exchanged into the new securities. Globe Telegraph and Trust ordinary put on £1, improving to 25½. It is to be hoped that there may be no disappointment in store for recent purchasers who bought on recommendation that overlooked the probability of the Trust's receiving no dividend, in the current year's accounts, from its holding of Cables and Wireless A stock.

Marconi Marines.

Marconi Marine shares are flat at 2¾, at which they show a fall of 3s. 9d. on the week. The weakness has nothing to do with the drop in Cables and Wireless. It is assumed, in the market, that the previously-paid dividend of 15 per cent. will be repeated, if not advanced. If so, the yield comes to practically 5½ per cent. on the money. The fall which has occurred from 3¾ to the present price is said to be due to the falling-through of certain arrangements that had been made for marketing the shares in New York. It was expected that they would be placed upon the Kerb Market there, but the intention became frustrated, and, according to the current gossip, a certain number of shares had to be sold.

"Sofina."

G.E.C. ordinary, while showing no nominal change in our price lists at 2¾, had a sudden spurt this (Tuesday) evening after hours, when New York sent over substantial buying orders, and lifted the price to 62s. Associated Electric ordinary remain at 47s. 6d. English Electric ordinary are something of a feature, with a rise of 2s. 6d. to 8s. 9d. Enfield Cables are a good market at 4 9/16 bid. British Aluminium, on the other hand, are a little lower. Lively dealings have been taking place in the shares of the Sofina Company, a Belgian undertaking which controls a large number of traction and utility undertakings in various parts of the world, and has an influential board and powerful backing. The shares are of the nominal value of 500 Belgian francs, and the dealings, which are now taking place are in fiftieths of these shares, the price of each fiftieth part being about 82s. The dividends paid so far have been negligible, the policy of the company being directed to building up substantial reserves before distributing profits. The company is understood to have a substantial interest in Hydro-Electrics, and in some of the other Utilities, the shares in which have recently enjoyed spectacular rises. But the real reason for the improvement can probably be better seen in the fact that attention has been called to the shares, and interest aroused in them, amongst a fairly wide circle of speculative investors.

Miscellaneous Matters.

Victoria Falls and Transvaal Power ordinary are easier at 63s. 9d. Some of the mining companies in South Africa have lodged protests at the high charges made for power by the Electricity Supply Commission, and the matter is being made the subject of official inquiry. The iron and steel market is decidedly better. Although Vickers remain dull at a trifle under 10s., most of the other issues in this group are steadily improving. The strength has spread to Babcock and Wilcox, where the price has risen 1/16 to 67s. Amongst other miscellaneous movements, slight declines in rubber shares occurred in consequence of a shrinkage in the price of the raw material. Automatic Telephones weakened to 38s. 3d., a fall of 1s. 9d., and Internationals have receded to the same price.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Sept. 3 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	68/9	—	4 4 9
Brompton Ordinary	1	8½	8½	26/6xd	+1/16	5 5 8
Charing Cross Ordinary	1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref. ...	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8¼	8¼	25/6	—	5 9 10
City of London	1	10	10	33/3	—	4 4 6
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Clyde Valley	1	8	8	26/8	—	... ...
County of London	1	7	10	57/6	+2/6	8 9 9
do. do. 6% Pref.... ...	1	6	6	23/-	—	5 4 4
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	53/3	—	4 2 8
Kensington Ordinary	1	8	8	26/-	—	5 7 8
Lancs. Light and Power	1	7½	7½	28/6	+6d.	5 5 2
London Electric	1	8½	9	27/6xd	—	5 1 10
Metropolitan	1	9	9	45/-	+1/16	4 0 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6½	6½	34/6	+6d.	3 15 4
Mid. Elec. Power	1	15	8	37/6	—	4 5 4
Newcastle-on-Tyne Ordinary ...	1	6	6	27/-	—	4 9 0
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref.	1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	1	8	8	26/6	—	5 5 8
Scottish Power	1	8	8	31/6	+6d.	5 3 3
South London	1	8½	8½	26/6	—	5 5 8
Urban Ordinary	1	7	—	38/8	+1/16	... ...
Westminster Ordinary	1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	25/-	—	6 0 0
Yorkshire Elec.	1	8	8	26/6	+6d.	4 7 8

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71xd	—	5 13 8
Metropolitan	„	8	9½	59½	—1	5 17 8
do. District	„	4	5	72½	—	6 18 ...
Underground Electric	£1	5	7	23/6	—6d.	5 19 ...
do. do. Income ...	Bonds	6	6	111xd	—2	5 8 ...

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103	—	5 16 6
do. Def.	„	1½	1½	24½	+½	6 4 5
Automatic Telephone	1	10	12½	38/3	—1/9	6 11 0
Cables & Wireless 5½ Pref.	Stock	—	—	95	—	5 15 9
do. A 7½ Ord.	„	—	—	82½	—	... ...
do. B Ord.	„	—	—	65½	—6½	... ...
Globe Tel. and T. Ord.	10	10	10	25½	+1	*3 18 6
do. do. Pref.	10	6	6	11	—	5 9 1
Great Northern Tel.	10	20	17½	81	—	5 13 0
Indo-European	25	10	10	47½	—	*5 5 3
Marconi-Marine	1	12½	15	2¾	—3/16	5 9 1
Oriental Telephone Ord	1	12	12	3	—	... ...

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	9 7/16	—	8 0 0
do. do. 2nd Pref. ...	5	6	6	9 7/16	—	8 14 6
do. do. 5% Deb. ...	Stock	5	5	74½	—	6 14 3
British Electric Traction Def. Ord.	„	5	5	1650	—	... ...
do. do. Pref. Ord.	„	8	8	128	—	6 5 6
Brazil Traction	100	7	8	73	+2	2 14 9
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	91½	—	5 5 10
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ...
London United Tram Deb. ...	Stock	4	4	57	—	7 0 4
Mexico Trams, 5% Bonds ...	—	5	5	77½	+2½	6 9 0
Mexican Light Common	100	Nil	Nil	104½	+2	... ...
do. 7% Pref.	100	7	7	81½	—	8 11 10
do. 1st Bonds ...	—	5	5	78	—	6 8 2
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	2¾	—	2 10 6
Babcock & Wilcox	1	13	15	67/-	+1/2	*4 9 7
British Aluminium Ord.	1	10	10	49/6	—6d.	*4 1 0
British Elec. Transformer Pref. ...	1	7	7	13/9	—	9 6 8
British Insulated Ord.	1	15	15	8¾	—	4 0 0
Brush Ord.	Stock	10	10	131	—	7 12 8
Callenders	1	15	15	8¾	—	4 0 0
do. 6½% Pref.	1	6½	6½	1¾	—	5 4 0
Crompton Parkinson Ord.	5/-	—	—	22/6	—	... ...
do. 8% Pref.	1	8	—	25/-	—	6 2 5
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4 9/16	+1/16	4 7 9
English Electric	1	Nil	Nil	8/9	+½	... ...
do. do. Pref.	1	8	Nil	8/-	+6d.	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2¼	—	9 9 5
Henley...	1	25	30	6¼	—¼	4 16 0
do. 4½% Pref.	5	4½	4½	44xd	+2/-	5 6 0
India-Rubber	1	Nil	Nil	12/6	—	... ...
Johnson & Phillips	1	10	—	3	—	5 0 0
Siemens Ord.	1	7½	7½	30/-	—	5 0 0
Telegraph Construction	12	10	10	23	—	5 4 2

* Dividends paid free of Income Tax.

The British Association.—III.

Two papers on electrical engineering problems read before the meeting of the British Association for the Advancement of Science at Johannesburg, South Africa.

By OUR SPECIAL COMMISSIONER.

Limits of the Economical Transmission of Electric Power.

By PROF. MARCHANT, D.Sc., M.I.E.E.

(Abstract of paper read before Section G.—Engineering.)

The transmission of electrical energy nowadays is primarily an economic problem, and there is no great technical difficulty in transmitting energy over distances of several hundred miles. Experiments have been made on overhead transmission lines (more closely resembling bridges than the transmission lines to which we are accustomed) which are designed for operation at a pressure of one million volts.

It has often been suggested that the most economical arrangement would be one in which the power station was located at

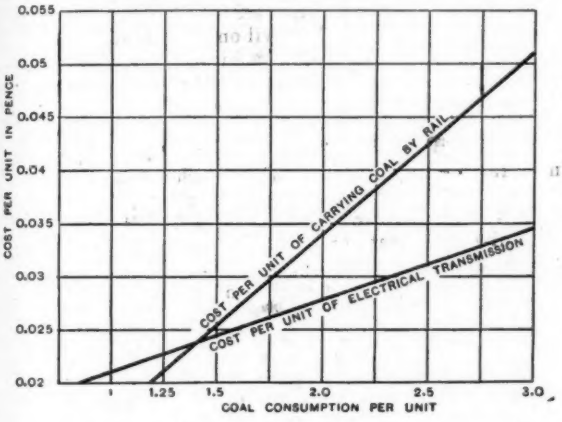


Fig. 1.—Comparison for Varying Coal Consumption per kWh.

the coal mine, and the energy conveyed electrically to the place where it was to be used; but in settling the site of a modern super-station there are many factors, such as the supply of water, which have to be taken into account besides the proximity of a coal mine. As an illustration, the case of a town such as Liverpool may be considered, which has adequate railway facilities, and is about 20 miles from the Wigan coal field. Assuming that stations of 100,000 kilowatts of equal thermal efficiency can be erected at the same cost in either Wigan or Liverpool, the only extra charge involved for the Liverpool station is the cost of conveying coal from Wigan, amounting to 3s. 2d. per ton. For a station of this size a thermal efficiency of 20 per cent. may be assumed as a working figure. Hence 5×3,430=17,150 British thermal units must be used per unit, or, taking coal with a calorific value of 11,500 B.th.u. per lb., the consumption of coal per unit generated is very nearly 1.5 lb. The extra coal cost in Liverpool is 0.0254d. per unit.

To convey the energy electrically would involve the installation of transformers at Wigan and Liverpool, and the erection of an overhead transmission line capable of transmitting 100,000 kW. It has been assumed that the line operates at a pressure of 132,000 volts, a pressure rather less than that estimated from the empirical formula given by W. P. Dobson for overhead transmission lines in America, *i.e.*:—Pressure in kilovolts=5.5 $(L+kW/100)^{\frac{1}{2}}=176$ kilovolts.

A later formula given by Evans and Sells gives 150 kilovolts.

The cost of transformers used in the English "grid" scheme is approximately 8s. per kW, and the two sets would therefore cost £80,000. The cost of the switchgear for controlling the output to a duplicate high-voltage transmission line is approximately £70,000.

The three-phase overhead transmission line is required to carry a maximum load of 100,000 kW at, say, 0.9 power factor and 132,000 volts. Such a line would consist of a standard double-circuit six-wire line, with each of the six conductors of aluminium-steel of equivalent conductivity to 0.175 sq. in. copper, carried on wide-base lattice towers with 900 ft. normal spacing. Such a transmission line would cost (at £3,000 per mile) £60,000. The usual loan period for this class of work is 25 years, which involves a charge for depreciation and sinking fund of 2.56 per cent. Allowing interest at 5 per cent., this gives a standing charge for capital expended of 7.56 per cent., say, 7.6 per cent., or £16,000 per annum.

Assuming a load factor of 31 per cent., the number of units transmitted per annum is 270 million, and the additional cost per unit due to standing charges is 0.0142d. per unit. With a no-load loss for 100,000 kW of transformers of 330 kW, the average copper loss over a year with a 31 per cent. load factor is 140 kW; the ratio of iron loss to copper loss has been taken at 1 : 2.5 at full load. The total loss in the two sets of transformers, therefore, is 940 kW.

The resistance for 20 miles of line is 2.6 ohms. The r.m.s. current with a load factor of 31 per cent. (assuming a form factor of 1.33) works out at 200 A, giving an average power loss over a year of 312 kW. The approximate average power loss, therefore, in the transformers and line amounts to 1,252 kW, and the units wasted per annum equal 11.0×10^6 units, or approximately 4 per cent. of the units transmitted. The works cost of generating electrical energy (*i.e.*, charges for coal and oil) in a station of this size in Liverpool, according to published tables, is about 0.25d. per unit, and the wasted energy involves, therefore, an additional cost of approximately 4 per cent. of 0.25d., or 0.01014d. The total extra cost per unit, therefore, of conveying energy electrically between these two places amounts to 0.0243d. per unit, compared with the additional charge of 0.0254d. for carrying coal. There is thus a difference of only 0.0011d. per unit between the cost of carrying coal and of conveying the energy electrically.

If the coal consumption per unit were reduced from 1.5 lb. to 1 lb., the cost of coal transport would be reduced in direct proportion to the fuel consumption per unit, but the cost of electrical transmission would only be affected by the reduction in the cost of the waste energy. Fig. 1 shows the relation between the cost of carrying coal and fuel consumption per unit and the cost of conveying electrical energy and fuel consumption per unit, for a range of from 1-3 lb. of coal.

The cost of transport varies directly with the fuel consumed, and falls from 0.051d. per unit, with 3 lb. of coal per unit, to 0.017d. with 1 lb. of coal per unit. The cost of waste energy is also reduced, and so the cost of generating 1 unit falls from 0.25d. at 1.5 lb. of coal per unit to 0.167d. at 1.0 lb. of coal per unit, and rises to 0.50d. at 3 lb. of coal per unit.

This result shows that the case for electrical transmission is less strong when the generating plant in the central station is more efficient. At 20 miles' distance there will be equality of cost between the two methods when the consumption of fuel per unit is about 1 lb. of coal.

It is evident that the relative advantages of transporting coal and conveying energy electrically will vary with the distance between the coal mine and the centre of the distributing network. The cost of hauling coal over distances of 20 miles and 100 miles are 3s. 2d. and 9s. 6d. per ton, respectively. The

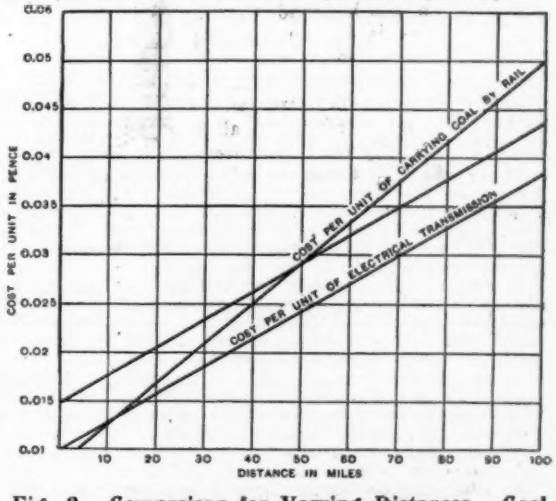


Fig. 2.—Comparison for Varying Distances. Coal Consumption: 1 lb. per kWh.

cost of transport of coal is made up of two parts, one depending on the cost of hauling the coal along the track, and the other on the cost of handling at the terminals. The cost of hauling along the track is proportional to the distance covered, and the cost of handling at the terminals is the same for the two hauls.

We can represent the cost of hauling coal, therefore, as equal to $A+BL$, where L is the distance in miles over which the coal is transported, and A and B are constants. The values obtained from the above figures are $A=19.2$ pence and $B=0.95$ pence, respectively. This gives a cost of handling coal at each terminal

of 9.6 pence per ton, and a cost of hauling coal per ton-mile of 0.95 pence. Assuming that the station uses 1 lb. of coal per unit, one ton of coal will produce 2,240 units, and therefore the cost per unit of handling coal is equal to 0.0085+0.00032 L pence. The curve in fig. 2 shows the way in which the cost of coal per unit delivered varies with the distance from the source of supply.

If energy is conveyed electrically, the cost of transmission may also be divided into two parts, one of which depends on the distance; the other does not. The fixed part of the electrical transmission charge is the capital charge on the cost of transformers and swithgear at the two terminals, and the cost of the loss of energy in transformation. The variable part is made up of the capital charge on the cost of the transmission line and the cost of the energy wasted in it. Taking the figures given above for the cost of transformers of 100,000 kW capacity, and taking the capital charge at 7.6 per cent. on £150,000 (the cost of transformers and switchgear), the annual charge amounts to £11,400 per mile. The cost of the transmission line is £3,000 per mile, and the annual charge at 7.6 per cent. amounts to £228 per mile; the annual charge, therefore, for erection of transformers and transmission line is £11,400+228 L. Assuming a works cost of, say, 0.17d. per unit, the annual charge for energy lost per kW is £6 approximately. The loss in the transformers costs £5,650 per annum.

The losses in the line amount to 15.6 kW per mile, and involve an annual charge of £94 per mile of line. The annual charge for the losses, therefore, is £5,650+94 L per annum, and the total annual charge amounts to £17,050+322 L.

Since the number of units transmitted is 270 million, the total annual charge in pence per unit works out at 0.0151+0.00286 L pence. This quantity is shown in fig. 2.

With a consumption of 1.5 lb. per unit, the cost of transport of fuel is increased 50 per cent., and amounts to (0.0128+0.006) pence per unit. The annual capital charge on electrical transmission remains unaffected, and equals £11,400+228 L. The works cost is equal to 0.25d. per unit (as against 0.17d.), and the cost of the energy lost in the transformers and the transmission line is £(8,500+150 L) per annum. The total annual

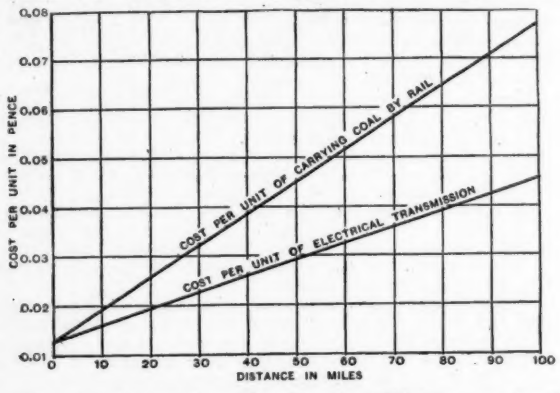


Fig. 3.—Comparison for Varying Distances. Coal Consumption: 1.5 lb. per kWh.

charge for electrical transmission, therefore, is increased to £(14,570+368 L) pence. Curves are drawn in fig. 3, and it will be seen that the electrical method of transmission is more economical when the distance covered exceeds 15 miles.

The figures given above are all calculated on the basis of a 31 per cent. load factor, the approximate value to-day in a large town like Liverpool. It is of interest to consider the effect of varying load-factor. As a standard for comparison the case worked out in the first section may be taken. If the load-factor is increased to 50 per cent., the number of units transmitted will amount to 435×10^6 per annum.

There may be a slight reduction in the fuel consumed per unit generated, but if the generators in the station are operated always near their most economical load the difference will be small. The cost of transport of coal per unit generated will, therefore, not be affected to any appreciable extent.

As regards the electrical method of transmission, the capital costs of the transformers and line will remain unaltered, and the charge per unit generated will, therefore, be reduced in the ratio of 31 : 50, and will amount to 0.0088d.

The iron loss in the transformers will remain unaltered, but the copper loss in the transformers and line will be increased.

In estimating the copper losses at 50 per cent. load factor, the "form factor" may be taken at 1.17 instead of 1.35, and the r.m.s. current flowing through the transformer and line may be taken at 280 amperes. The copper loss in the transformers will, therefore, be increased to 274 kW, and in the line to nearly 620 kW. The total average power loss involved in the transmission is increased to 1,830 kW, and the units lost per annum $=16\times10^6$. Taking a works cost of 0.25d. per unit, the additional cost due to losses is approximately 1,600/435= 3.7 per cent. of 0.25d., or 0.00825d. per unit.

The total cost per unit, therefore, for electrical transmission amounts to 0.01792d. per unit. This result shows that the case for electrical transmission is stronger with an improved load factor, though the actual reduction in the cost of transmission per unit depends on the ratio of capital to running charges. The ratio of capital charges to cost of waste energy in this case, according to Kelvin's law, is nearly correct, the capital charges amounting to 97 per cent. of the cost of the waste energy. In this case it is interesting to note that although the capital charges are reduced in the ratio of 31 : 50 or 0.62, the cost of the energy losses in the transformers and line are only reduced in the ratio 3.7 : 4.05 or 0.915.

A case which has often to be considered is that of the relative cost of obtaining electrical energy from a water-power plant and from a steam plant. The position of the water-power plant is fixed, but the position of the steam plant may be varied within considerable limits. As a rule it will be found economical to place the steam plant as near as possible to the electrical centre of gravity of the load which it has to supply, since the difference in cost of transport of fuel to different sites within a radius of a mile or two, as compared with the increase in cost of electrical distribution involved by displacing the central station from the electrical centre of gravity, is usually negligible. One can assume, therefore, that the steam station can be placed close to the centre of gravity of the load, thus reducing the cost of the distributing network to a minimum. With a water-power station an overhead transmission line has to be constructed from the power station to the electrical centre of gravity.

The total works cost of generating electrical energy in a steam station such as Barton, Manchester, is 0.6d. per unit, and the capital charge for interest and sinking fund 0.41d. per unit. With a 31 per cent. load factor, and assuming the interest and sinking-fund charges to be 7.6 per cent. of the capital expenditure, this corresponds with a capital expenditure per kW of maximum demand of very nearly £61.

The running charges in a hydro-electric station may, as a first approximation, be taken at about 0.1d. per unit for maintenance and labour.

As the total generating cost in a steam station of about 100,000 kW capacity may be taken to be 1d. per unit, 0.9d. per unit is available to cover the capital charges on a hydro-electric station. Capitalising this on the basis already assumed, the maximum permissible expenditure with a 31 per cent. load factor is £133 per kW of maximum demand. For a 600-mile line the total cost, at £3,000 per mile, will amount to £1,800,000; adding the cost of transformers and switchgear will bring the total to roughly £1,950,000.

The maximum load is 100,000 kW, and this corresponds with a capital expenditure of £19.5 per kW, which leaves available for necessary engineering works at the hydro-electric power house a total of approximately £113.5 kW. This figure will have to be reduced by at least 30 per cent. to allow for spare plant, and, therefore, a capital expenditure of £80 per kW of plant installed may be taken as the maximum permissible. This figure corresponds fairly closely with that given by the Electricity Commissioners for the maximum capital expenditure which is permissible on the development of a small hydro-electric plant in England.

Another scheme was put forward by Steinmetz some years ago, which he called "quarter-wave transmission," in which the transmission was from constant current at the transmitting end to constant pressure at the receiving end. This scheme has never been used on a large scale, although one sees it in practice with very high frequency in an ordinary wireless transmitting aerial, which is a quarter-wave transmission working at no load.

It is interesting to note that the length of a quarter-wave transmission line working at 60 cycles and made of wire 0.706 in. diameter, is very nearly 700 miles, and, therefore, it should be practicable, by using suitable "loading," to install quarter-wave transmission on a 600-mile line, and to maintain constant pressure at the receiving end by controlling the generators at the sending end for constant current.

It is possible that, if the cost of fuel in South Africa increases, and if the load factor of the Rand is improved, the exploitation of the Victoria Falls for the supply of power to the gold mines on the Rand may become economically feasible.

The National Scheme of Electricity Supply in Great Britain.

By Charles H. Merz, M.I.E.E.

(Abstract of Paper read before Section G—Engineering.)

"The compact nature of our industrial districts and their proximity to each other, as compared with those of other countries, such as the United States and Germany, make it economically possible and advantageous to deal with all the power requirements of the community in each industrial area from inter-connected electrical power distibution systems tapping all sources of power, however scattered, and delivering electrical energy wherever required. . . . ."

"Proceeding on these lines we shall not be merely copying America or Germany—we shall be doing something that is right for England because it is England, and because England is radically different from other countries as regards the technical development and 'layout' necessary to secure cheap power. We have delayed making a start on right lines 15 years longer than is necessary—let us delay no longer."

The above paragraphs are from a paper presented by the author to the British Association at Newcastle in 1916.

It was not until the beginning of this century that the possibility of commercial distribution over areas larger than the urban districts hitherto adopted was generally realised. Be-

tween 1900 and 1906 Parliament granted to a number of undertakings throughout the country powers to supply over areas several hundred square miles in extent. By 1917 the largest power company in this country had a network covering some 1,400 square miles—an area subsequently extended to 4,150 square miles.

The first report of the Fuel Economy (Power and Steam-raising) Committee appointed, by the British Association in 1916, incidentally referred to the subject of electrical distribution. The Coal Conservation Committee (Ministry of Reconstruction, 1917), of which Lord Haldane was chairman, emphasised the need of interconnecting generating stations. The Board of Trade Committee (1918), of which Sir Archibald Williamson (now Lord Forres) was chairman, recommended the establishment of the Electricity Commissioners and of Joint Electricity Authorities, who were to co-ordinate the work of electricity supply undertakings and bring about the construction of larger regional networks than were generally in being.

The recommendations of the two latter Committees were embodied in the Electricity Bill of 1919. The compulsory powers sought in this Bill were, however, deleted, with the result that the Electricity Commissioners were seriously hampered in carrying out the developments which the Act was intended to bring about. The 1919 Act did, however, give the Electricity Commissioners certain powers to prevent the erection or the extension of an uneconomical generating station when bulk supply on better terms was available. The Act also made some provision for obtaining wayleaves.

In 1925 the Government appointed the "Weir Committee" "to review the national problem of the supply of electrical energy and to present a report on the broad lines of policy which should be adopted."*

The seven years which elapsed between the Williamson and Weir Committees had shown that interconnection *between* the areas, that is of the country as a whole, was a *sine qua non* of any really sound policy of development in a densely populated industrial country.

Effect was given to the pricipal findings of the Weir Committee by the Electricity Supply Act of 1926, and since then the Central Electricity Board has been established with powers following fairly closely the recommendations of the Weir Report. Under the Act schemes are prepared by the Electricity Commissioners and carried out by the Central Electricity Board. These schemes provide for:—

(*a*) The selection of generating stations which are to be retained in operation.
(*b*) The interconnection of the selected stations with one another and with the generating stations of other authorised undertakers.
(*c*) The standardisation of frequency.

In connection with the operation as distinct from the construction of the schemes, the Board has the further duties of:—

(a) Deciding upon the load ng, output, and running hours of the selected stations;
(*b*) Purchasing at cost price all energy generated therein and supplying it directly or indirectly to authorised undertakers;
(*c*) Arranging for extension or alteration of selected stations.

The Board, in effect, takes full charge of all generation, but it has, in general, no power to distribute to individual consumers, which is left to the existing electricity supply authorities. The actual ownership and operation of all generating stations are still retained by the larger distributing bodies, and it is impossible for the Board itself to own or operate a generating station unless all attempts to obtain the necessary generating capacity in other ways have failed. Although the Board purchases the entire output of each selected station, the owner has the choice, as an alternative to the general "grid tariff," of buying back his own requirements at cost price, adjusted for load factor, plus a proportion of the Board's expenses, up to the full output at which the station is operated. In practice the greater output obtainable from the station, due to its connection to the "grid," will result in a reduction of generating costs which will more than balance the addition of the proportion of the Board's expenses. The effect of this arrangement is threefold:—

(*a*) Even the largest and most efficient of supply undertakings are ensured a direct saving through the Board's operation.
(*b*) The owner of a selected station has a personal incentive to operate his station in the most efficient manner.
(*c*) It is an advantage to a supply undertaking to own a selected station of the largest and most economical type, and therefore no difficulty is likely to be experienced by the Board in arranging for extensions of generating plant to deal with increasing load.

The Act further provides that where standardisation of frequency (to 50 cycles) is essential for the purpose of any scheme, the Board can require it to be carried out at the Board's expense.

The Weir Committee estimated the probable capital expenditure of the Board in the first five years as £25,000,000, in addition to £8,000,000 representing the cost of frequency standardisation. The Act provides that the charges on the capital expended on frequency standardisation shall be repaid to the Board by the Electricity Commissioners who, in turn, are empowered to recover it by a levy on all electricity supply undertakings in proportion to their revenue. The Act also provides that the Treasury may guarantee the principal of and the interest on any loans raised by the Board up to an aggregate amount of £33,500,000. The Board has power to pay interest out of capital for the period during which the capital expenditure remains unremunerative, and also to suspend sinking-fund payment for a period not exceeding five years.

There are many precedents for the design of high-voltage transmission systems for transmitting large blocks of power from the sources to centres of heavy load. The "grid," however, is primarily an equalising and distributing system, and only partly a transmission system. In Great Britain the sources of energy are comparatively close to the users and to each other, and the chief function of the "grid" is to enable the most efficient generating stations to operate at the highest load factors and to reduce the amount of spare plant required.

The systems adopted throughout Europe, with the exception of Italy, are uniformly 3-phase, 50 cycles.

The adoption of 132 kV for the main grid (which is already in extensive and growing use in Australia, Brazil, France, Italy, South Africa, Sweden, and Switzerland, as well as the U.S.A.) has the advantage that cables for operation at that voltage are being satisfactorily developed.

The general lay-out of the "grid" consists of some 3,000 miles of 132-kV, three-phase, 50-cycle overhead lines as a series of ring mains connecting the largest generating stations and cross-connected to each other at strategic points. This network feeds transforming stations with installed capacities varying from about 15,000 kVA up to, in one instance, 400,000 kVA. These transforming stations feed secondary networks, which supply groups of transforming stations ranging in capacity from about 1,000 kVA to 10,000 kVA. Many of these secondary networks consist of overhead lines, and a voltage of 33 kV has been selected as most economical, except in the London district, where there is to be an extensive 66-kV underground secondary system. As a rule it is more economical to deal with loads requiring less than 15,000 kVA of transforming plant from the secondary network.

The construction of some 3,000 miles of 132-kV overhead lines and many miles of lines at lower voltages must introduce difficult wayleave problems, particularly in Great Britain, which is not only populated very densely and covered with a vast network of roads, railways, and overhead communication lines, but also very careful of vested interests.

In consequence, overhead construction has hitherto been relatively little used as compared with Continental and American countries. The time taken to negotiate wayleaves was also a serious handicap. In recent years the wayleave situation has been considerably improved and the Government safety regulations have been put on a more reasonable basis, although they are still severe as compared with other countries.

The question is sometimes asked as to the necessity for taking any special steps to lay down the grid, as compared with allowing the existing undertakings to develop without its assistance. Perhaps the best answer is to look at what would have happened had no steps been taken to lay down the national system of inter-connection. The 438 generating stations which supply this country would, in all probability, have been gradually reduced in number, but numerous comparatively small stations would inevitably have been extended or laid down. These small units and stations are extravagant in first cost and in operating cost. Moreover, as the inefficient small unit becomes obsolete more rapidly than the more efficient large one, there is heavy depreciation. The small unit cannot produce current at a price low enough to ensure its general adoption for domestic purposes. The existing population and industries in the rural districts would not have obtained supplies for many years, and the establishment of new industries in those districts would not have been achieved. The unification of the existing frequencies and voltages would have become more difficult every year, as would the standardisation of producing plant and domestic apparatus, so necessary for cheap production and widespread adoption.

The "grid" is admittedly an expensive work, but its justification is not so much an *immediate* reduction in the cost of electricity to the consumer as the initiation of a definite policy of future expansion, instead of the present haphazard development, and the provision of electricity in many new areas.

Hardly any part of the country is more than 100 miles, and few of the populous areas more than 50 miles, from the nearest coal field. Owing to our extensive coast line, coal can be delivered from the mine to the generating station at a very low cost, and the main function of the "grid" will not be to transmit large blocks of power, but rather to facilitate the inter-change of power between different centres in accordance with the varying demands and facilities for production. It will constitute, with the generating stations which it links up, a complete system for the production and supply of electricity, and enable full advantage to be derived from the diversity of loads, from the correct apportionment of total load from stations of varying efficiency, and from the elimination of obsolete and unsuitable plant. It will enable the future capital cost per kilowatt installed in the selected stations to be kept

* ELEC. REV., March 26th, 1926, p. 516.

down, owing to the possibility of using the largest and most efficient plant. Where hitherto undertakers have hesitated to put down the largest possible, and hence the most efficient and cheapest, units of plant in advance of the load because of the capital charges to be met, no such considerations will now apply, as the grid will enable the plant to be employed to its full capacity from the outset, the Central Electricity Board agreeing to purchase as soon as available the whole of the energy which can be produced. It will be possible for new stations to be erected on the most efficient sites away from the centres of population, thus reducing railway congestion caused by the carriage of coal, and avoiding the creation of nuisances in populous centres. It will allow the aggregate amount of spare plant to be considerably reduced, and will also enable large quantities of waste heat from blast-furnaces, coke ovens, and other sources to be transformed into electric power and usefully employed. It will also permit such water power resources as Great Britain possesses to be tapped, but will avoid in many cases the large expenditures in civil engineering work connected with hydro-electric schemes which have hitherto been necessary in order to provide adequate storage for the shortage of water during the dry season of the year.*

The spread in the use of electric power will not only have an important effect upon the conditions in factories and in private houses, but also far-reaching results on the atmospheric conditions obtaining in great towns. Electric heating and cooking offer so many advantages that, even in districts where the cost of electric power is high, they are making considerable progress. But in London and many large towns the domestic fire is still probably responsible for the bulk of the pollution.

Owing to the low efficiency of domestic fires and coal-fired heating and cooking apparatus in general, it is probable that for no greater consumption of coal the whole requirements of the country in regard to domestic fuel could be supplied electrically from modern power stations.

The latter can supply power—"off the peak"—at very low rates. While electricity cannot be conveniently stored and is, therefore, relatively an expensive form of energy at those times of the day when the demand is great, there is no difficulty in storing in the form of hot water the energy required for the heating of buildings. An installation of the thermal storage type has now been in operation for some considerable time in a modern office building in Newcastle-upon-Tyne. The cubic capacity of the building is 1¾ million cubic feet, and the whole of the heating requirements are dealt with by panel type radiators built into the ceilings of the rooms and supplied with hot water at a temperature of about 110 deg. F. from a storage system located in the basement. Heat is supplied to the storage system by electric boilers which are on load only at night when the general demand is low. The cost of supplying such heat practically represents only the cost of the additional fuel consumed.

If the entire fuel requirements of an average English community were supplied electrically, it appears that the resulting consumption for domestic purposes would be of the order of 1,500 kilowatt-hours per inhabitant per annum, compared with the estimate of 500 kilowatt-hours per annum for all purposes, which it is anticipated will result in 1940 if present methods are adhered to. It is clear, therefore, that the result of drastic action to eliminate the open fire over a period of years would not cause such a disproportionate demand for electricity that the requirements could not be met.

One method of bringing such a change gradually into being would be to provide that all town planning schemes should contain provisions for the supply of electricity and gas on economic terms and in sufficient quantity for supplying the entire fuel requirements of the area. The installation of open domestic fires in new houses under such schemes might even be prohibited by law and the continuance of open fires in other cases could be discouraged by taxation. Such steps may appear drastic at the present time, but compulsion is already placed upon owners of property in connection with water supply and sanitation.

As regards the power stations themselves, modern methods are reducing the production of smoke to a minimum, but the grid will certainly facilitate this and result in the location of generating stations in districts remote from population. Public opinion is beginning to demand that as much as possible be also done to eliminate the discharge of sulphurous fumes into the atmosphere.

If the legislative pressure above suggested be adopted, combined with the provision of a supply of electricity at a steadily falling price, a great improvement in the atmospheric conditions in large towns might be expected at a comparatively early date. In 10 to 15 years the majority of domestic fires and other sources of smoke and fumes in towns might reasonably be expected to have disappeared, at least in residential districts, while in, say, 25 years there is no reason why these sources of pollution should not have completely disappeared. The increase in the output of electricity to meet domestic consumption would operate to reduce the price of electric power for industrial purposes, and hence affect very materially the costs of production in many branches of industry.

The delivery of coal to centralised instead of to scattered points would effect a considerable saving in distribution. Apart from the impetus given to coal carbonisation and kindred processes by the establishment of very large power stations, the total demand for coal would almost certainly increase, since every economy in the utilisation of coal may be expected to produce greater demands for power in industry.

Great Britain can claim to be the first country to lay down a comprehensive national system of electric trunk mains, thus maintaining its traditional attitude as a pioneer in engineering. The amount of mechanical power used *per capita* is to-day a true criterion of development in a manufacturing nation, while the amount of power used for domestic purposes (whether in the form of coal, gas, or electricity) bears a definite relation to the standard of living. The extended use of power increases both the amount of wages earned and the amount of comfort these wages will buy.

* Parliamentary powers have recently been granted for the establishment in S.W. Scotland of a water-power scheme designed to take peak loads in conjunction with the grid.

The Electrical Trade of Hungary.

Statistics for 1927 and 1928 Compared.

THE following table gives particulars of Hungary's imports and exports of electrical machinery last year, the total values in 1,000 pengos being stated, together with the total weights in quintals, and the weights by countries of origin or destination. Comparative figures for 1927 are added, and notes of any increases or decreases also given :—

Imports.

	1927.	1928.	Inc. or dec.
Dynamos, motors, and transformers—			
Value in 1,000 pengos	4,112	4,910	+ 798
Quintals	7,268	8,451	+1,183
From Austria	3,181	2,920	− 261
,, Czecho-Slovakia	37	260	+ 223
,, Germany	2,177	3,390	+1,213
,, Italy	478	100	− 378
,, Switzerland	625	950	+ 325
,, Sweden	*	240	—
Heating and cooking apparatus—			
Value in 1,000 pengos	177	150	− 27
Quintals	163	170	+ 7
From Austria	47	40	− 7
,, Germany	112	115	+ 3
Electric meters—			
Value in 1,000 pengos	383	500	+ 117
Quintals	248	320	+ 72
From Austria	37	30	− 7
,, Germany	193	290	+ 97
,, Belgium	13	—	− 13
Electric measuring and signalling apparatus—			
Value in 1,000 pengos	151	285	+ 134
Quintals	120	85	− 35
From Germany	62	60	− 2
,, Austria	41	20	− 21
Telegraph and telephone apparatus—			
Value in 1,000 pengos	2,797	7,720	+4,923
Quintals	882	1,740	+ 858
From Austria	69	135	+ 66
,, Germany	465	970	+ 505
,, Holland	82	490	+ 408
Conduit, tubing, &c.—			
Value in 1,000 pengos	101	85	− 16
Quintals	655	430	− 225
From Czecho-Slovakia	54	25	− 29
,, Germany	479	310	− 169
,, Austria	113	85	− 28
Starters, resistances, regulators, &c.—			
Value in 1,000 pengos	3,522	4,850	+1,328
Quintals	3,896	4,950	+1,054
From Austria	875	995	+ 120
,, Germany	1,675	3,120	+1,445
,, Czecho-Slovakia	68	90	+ 22
,, Switzerland	*	310	—
Arc lamps and electric projectors†—			
Value in 1,000 pengos	225	335	+ 110
Quintals	162	228	+ 66
Incandescent lamps—			
Value in 1,000 pengos	714	800	+ 86
Quintals	475	400	− 75
From Austria	179	150	− 29
,, Germany	243	250	+ 7

Accumulators, batteries and parts—	1927.	1928.	Inc. or dec.
Value in 1,000 pengos	199	330	+ 131
Quintals	524	790	+ 266
From Germany	125	270	+ 145
„ Sweden	83	160	+ 77

Exports.

Electric measuring and signalling apparatus—			
Value in 1,000 pengos	51	*	—
Quintals	20	*	—
Dynamos, motors and transformers—			
Value in 1,000 pengos	3,640	4,580	+ 940
Quintals	13,339	15,420	+2,081
To Austria	1,829	2,060	+ 231
„ Czecho-Slovakia	200	120	− 80
„ Rumania	1,210	1,425	+ 215
„ Germany	36	890	+ 854
„ Italy	4,184	3,250	− 934
„ Spain	*	840	—
„ Poland	851	260	− 591
„ Jugo-Slavia	1,183	2,200	+1,017
„ Holland	*	940	—
„ Brazil	1,849	640	−1,209
„ India	*	450	—
Electric meters—			
Value in 1,000 pengos	849	1,120	+ 271
Quintals	1,125	1,440	+ 315
To Austria	23	40	+ 17
„ Rumania	210	170	− 40
„ Jugo-Slavia	146	140	− 6
„ Italy	230	120	− 110
„ Belgium	88	310	+ 222
„ Poland	*	200	—
Railway signalling and safety apparatus—			
Value in 1,000 pengos	—	24	+ 24
Quintals	—	8	+ 8
To Rumania	—	2	+ 2
Telegraph and telephone apparatus—			
Value in 1,000 pengos	2,630	2,220	− 410
Quintals	2,139	1,800	− 339
To Rumania	799	640	− 159
„ Germany	111	30	− 81
„ Jugo-Slavia	614	660	+ 46
„ Poland	80	10	− 70
Conduit, tubing, &c.—			
Value in 1,000 pengos	15	25	+ 10
Quintals	277	335	+ 58
To Rumania	209	310	+ 101
Starters, resistances, regulators, &c.—			
Value in 1,000 pengos	538	780	+ 242
Quintals	1,557	1,730	+ 173
To Austria	485	300	− 185
„ Jugo-Slavia	281	310	+ 29
„ Rumania	268	280	+ 12
„ Poland	95	65	− 30
„ Italy	114	150	+ 36
Incandescent lamps—			
Value in 1,000 pengos	7,836	9,690	+1,854
Quintals	9,556	12,130	+2,574
To Austria	324	300	− 24
„ Czecho-Slovakia	631	940	+ 309
„ Rumania	758	1,060	+ 302
„ Jugo-Slavia	789	830	+ 41
„ Germany	2,910	2,950	+ 40
„ Brazil	618	1,200	+ 582
„ Argentina	352	390	+ 38
Accumulators, batteries and parts—			
Value in 1,000 pengos	102	60	− 42
Quintals	562	275	− 287
To Jugo-Slavia	189	170	− 19
„ Bulgaria	356	75	− 281

1,000 pengos = £36 approx.

* Not specified.

† Mainly from Germany.

The Allen-Parsons Trench Excavator.

Details of a machine used for cutting trenches for electricity and other mains.

ANY method which will facilitate and cheapen the laying of cables must attract the serious attention of electrical engineers, and the Allen-Parsons trench excavator, which Messrs. John Allen & Sons (Oxford), Ltd., have employed for some time past in cutting trenches for various authorities, is, therefore, of interest.

These machines are made in a number of sizes, but experience has shown that Model 21 excavator (fig. 1) is the most satisfactory for the excavations required in this country. This model is capable of digging trenches to a depth of 7 ft., and from 18 in. to 42 in. in width. Motive power is provided by a 45 h.p. Twin City, heavy duty, oil engine, the power being transmitted through a gear box, which provides two speeds and reverse to all motions. Sixteen speeds, varying from 7 to

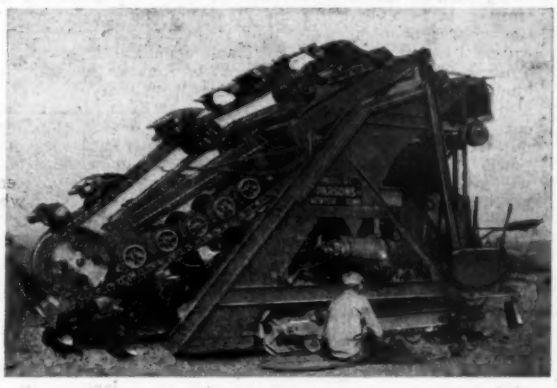


Fig. 1.—Model 21 Allen-Parsons Excavator.

62 in. of travel per minute are available for the actual operation of digging, which is carried out by single-piece buckets. In these buckets are inserted chrome-nickel teeth, which take the wear and are easily detachable and replaceable. A positive cleaner is employed to clean the buckets, and the machine can operate in very sticky material; it will also face soil which is unusually hard. The boom carrying the bucket chain can be moved to either side of the machine, or can be operated centrally.

A conveyor delivers the excavated material to either side of the machine, and change can be made to clear an obstruction while the machine is in operation. This is a considerable advantage, as trenches can be cut to within 7½ in. of a line of trees or posts.

The machine is mounted on full caterpillar tracks by a system of three-point suspension, so that the frame is not subject to twisting strains; and the large area of track on the ground permits travel on soft surfaces. It is extremely stable, owing to its low centre of gravity, steering being effected by

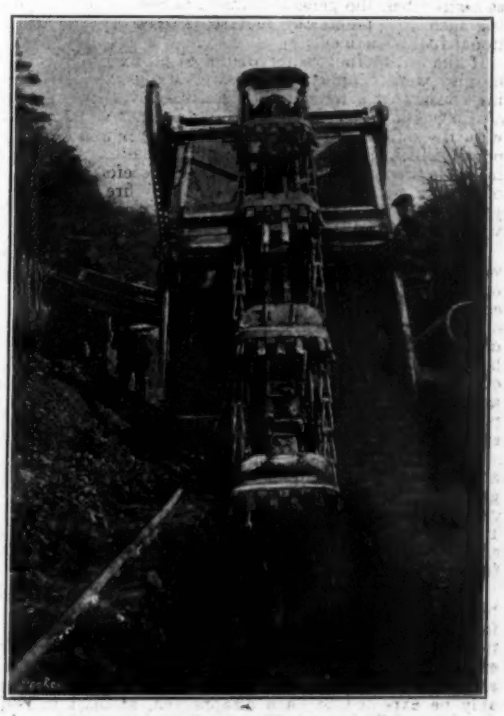


Fig. 2.—The Excavator in Action.

power drive independently to each track through clutches. A feature of the machine is its mobility. A pressure system of lubrication is fitted to all bearings, except those on the boom, which have large oil wells.

The machine can travel from job to job under its own power at approximately 1½ miles per hour, and is therefore practical even for digging short trenches. When the work lies several miles distant the machine can be loaded by its own power on to a wagon for transportation.

One of the excavators is shown in operation in fig. 2.

The 1929-30 Lighting Season.—II.

Electric Lamp Manufacturers' Propaganda.

THE efforts of the ELECTRIC LAMP MAUFACTURERS' ASSOCIATION during the coming lighting season will be concentrated upon the benefits of glareless lighting. This means that the "Pearl" and opal lamps will be kept constantly before the public in an endeavour to stimulate the sale of the standard ranges, which replace a multiplicity of types, and, incidentally, are better for the sight than the glaring clear-glass gas-filled lamp.

In the home, office, and factory there is a general need for greater intensity of lighting, and one factor which has militated against its realisation has been the increase of glare accompanying badly installed lamps of large wattage. With the use of pearl and opal lamps the necessary increase in intensity can be obtained without a suggestion of glare, even if they are unscientifically installed. In the case of the pearl type, the absorption of light is negligible—they give equal light without the disadvantages of the clear-glass lamp. With regard to the opal type, while the absorption is a little greater, it is entirely discounted by their pleasing appearance and the soft, diffused illumination which they give.

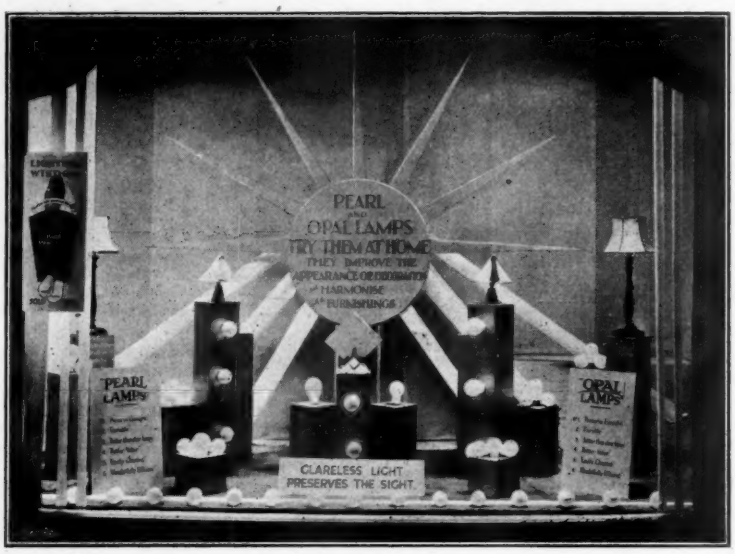


Fig. 1.—An E.L.M.A. Window Display.

Glareless lighting has a twofold economic value. To the user it means the abolition of eye-strain with its attendant evils. In industry and commerce this means better and quicker production, brought about by the more comfortable conditions, while in the home it means better health and temper. To the lamp manufacturer it means the elimination of the waste of time and effort which is entailed in the production of an unnecessary number of types, leading to more efficient manufacture and lower costs. This, again, will be of advantage to the user, as eventually it means lower prices for the lamps.

E.L.M.A. points out that at the present time the lamp manufacturer is called upon to stock over 2,000 lamps of different types and voltages, a matter which presents a very serious problem to the whole of the industry. It is obviously to the advantage of manufacturers, factors, and retailers to do all that lies in their power to remedy this state of affairs. Moreover, to encourage the adoption of the pearl lamp a larger discount is given, while the slightly higher prices of opal lamps give the dealer a better profit than the clear-glass type.

Fig. 2.—A Glareless Lamp Demonstrator.

During the autumn months, high-class periodicals throughout the country will contain informative articles dealing with the electric lighting in general, supported by display advertisements, and stressing particularly the necessity of using pearl and opal lamps, wherever possible, on the score of eyesight preservation. Instructive and informative publications dealing with glareless lamps will be available for distribution to the public by supply undertakings and retailers. Lecture-demonstrations are being organised in different parts of the country especially for members of the industry and trade. It is also hoped to arrange lecture-demonstrations for the general public in all the principal cities of the country. In this connection the Electrical Association for Women has volunteered to be responsible for organising such lectures under the auspices of its branches.

To assist in the campaign retailers are asked to show only pearl or opal lamps in their windows and showrooms, and to talk of the glareless properties of these lamps on every occasion. E.L.M.A. has designed a special window display for the purpose; this is illustrated in fig. 1. Retailers are asked to give prominence to a special window poster which is being distributed; to assist in the organisation of lecture-demonstrations in their districts, interesting local bodies in the subject; and to contribute notes on glareless lighting to the local newspapers, a matter in which E.L.M.A. offers "copy" and illustrations. Fig. 2 illustrates a lamp demonstrator, by means of which a customer can be shown the effects of pearl and opal lamps.

In our last issue we made mention of what the BRITISH THOMSON-HOUSTON CO., LTD., was doing to further the sales of electric lamps. We have since received a copy of an attractive brochure shaped to the figure five and containing details of the company's campaign in connection with the "Mazda five" (pearl lamps).

Fig. 3.—A Striking "Osram" Design.

The GENERAL ELECTRIC CO., LTD., has also sent us full particulars of its lighting season campaign. The general plan is set forth in a handsome publication entitled, "Doubling-up Sales." In consonance with the schemes of the lamp makers generally, the company concentrates upon the simplified range of pearl lamps, which, it is pointed out, replaces no fewer than 65 other types. The remarkable success which attended the introduction of the new range is commented upon; during last season, for every three "Osram" lamps which could have been drawn from the simplified line one was a pearl. This season, it is hoped that two out of every three will be pearls. The movement should be aided considerably by the fact that the pearl lamps are now cheaper than their clear-glass equivalents. It is a most remarkable feature of the campaign that the better lamp should cost the less. The superseded "sixty-five" are set out in full on one page of the brochure, and stress is laid upon the elimination of slow or unwanted stocks of these lamps. Extensive advertising is being carried out by the G.E.C. in the leading national newspapers and periodicals, including a number of trade and technical journals. Special showcards, pamphlets, &c., have been prepared for the use of retailers, and the most striking design employed is that reproduced in fig. 3. The cubist lion represents the nation; it gazes unblinkingly at a pearl "Osram" lamp.

New lamp price lists have been received from the BRITISH THOMSON-HOUSTON CO., LTD., SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD., and the TUNGSRAM ELECTRIC LAMP WORKS (GREAT BRITAIN), LTD.

A New Testing Set.

A description of the "Bridge-Meg" Resistance Tester recently introduced by Messrs. Evershed & Vignoles, Ltd.

THE success which attended the introduction in 1922 of the "Meg" insulation tester by Messrs. Evershed and Vignoles, Ltd., has led to the development of the "Bridge-Meg" Resistance Tester, fig. 1. This is a combined ohmmeter and generator of the "Meg" type, built into one case with a set of adjustable resistances. By the turn of a single switch the instrument serves either for measuring high resistances—testing insulation—or for the determination of conductor resistances by the Wheatstone Bridge method.

In a rectangular case of aluminium alloy, having a lid and base of moulded bakelite, four separately assembled elements are contained: a generator, an ohmmeter, a rheostat, or set of adjustable resistances, a "Bridge-Meg" change-over switch for changing from insulation to conductor measurements, and a ratio switch for use on the "bridge" setting.

When the tester is laid down for use the generator handle is on the right, the terminals at the opposite end of the case, the adjustment knobs of the rheostat on the top under the user's hand, and the switches on the side facing him. The dial is on the top of the case, so that the scale is easily read while the adjustments are being made. A system of guarded circuits is employed. Errors due to leakage over the surfaces of the instrument, which might otherwise arise when it is used in damp or dusty surroundings, are by this means eliminated. A carrying strap is permanently attached to the case. It is adjustable in length and can either be shortened for carrying the instrument in the hand, or lengthened if the "Bridge-Meg" is to be slung from the shoulder.

The generator is similar to that used in the "Meg" insulation tester, and is a self-contained unit assembled as shown in fig. 2. It has two windings which are connected in series for tests of insulation, and in parallel for "bridge" measurements, the voltage generated being 500 for "meg" tests and about 250 for "bridge" tests. The drive is transmitted from the turning handle to the armature through steel cut gears enclosed in an oil-tight casing. A free wheel, interposed between the handle and armature, allows the latter to come to rest slowly when the handle is released, so that it is impossible to damage the generator by stopping it suddenly. A constant-speed clutch of simple design is also interposed between the handle and the armature shaft, so that the speed of the armature remains constant, whatever the rate at which the handle is turned above the speed at which the clutch slips. The constant voltage developed is particularly important in tests of insulation when this has an appreciable electrostatic capacity, and in the final adjustment of balance in a "bridge" measurement.

The construction of the ohmmeter movement is shown in fig. 3. The moving-coil element is mounted on an axle pivoted in spring-supported jewels carried in a cast-aluminium frame, which also directly supports the dial plate. This arrangement ensures rigidity and accuracy. Connections are made through spirally wound ligaments which exert no appreciable control, so that the movement is to all intents and purposes free. Further, to ensure accuracy in case of any slight variation in these ligaments, an index adjuster is provided, operated by a small screw accessible from the outside of the case. This is a simple device, by means of which the field surrounding the pressure coil can be slightly distorted by movement of a small piece of soft iron. The index adjuster has no physical connection with the moving-coils, the control being entirely magnetic, and cannot therefore be used to injure the instrument.

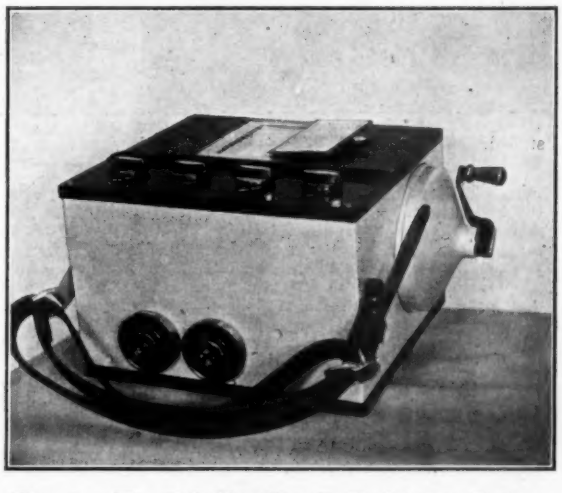


Fig. 1.—The "Bridge-Meg" Resistance Tester.

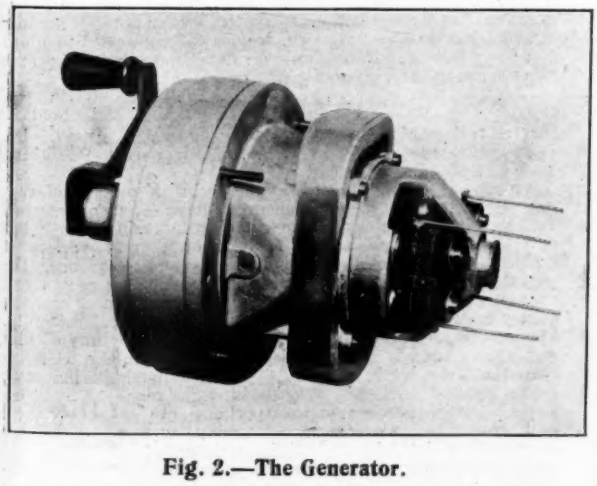


Fig. 2.—The Generator.

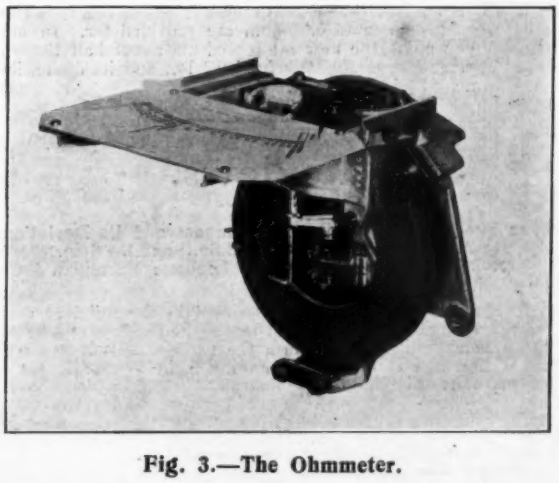


Fig. 3.—The Ohmmeter.

The change-over and ratio switches are combined in one unit, fig. 4. The change-over switch is of the drum type, having fixed brushes sliding over a rotating drum, which carries the contacts necessary to connect the brushes, as required, for the "Meg" and "bridge" settings, respectively. The position of the switch is shown externally by engraving on the handle. The ratio switch is of the plate type, and has two arms sliding between two sets of studs. The ratio corresponding to a given setting is plainly indicated externally by engraving on the handle.

The adjustable resistances, fig. 5, are of novel design, and, while considerably lighter and smaller than those employed in the resistance box of the "bridge-megger" set, are equally efficient in their operation. There are four sets of adjustable resistances: units, tens, hundreds, and thousands, giving values from 1 to 9,999, in steps of one unit. The value corresponding to a given setting of the dials can be read by numbers seen through small windows in the case.

For testing insulation the instrument is employed in the same way as a "Meg" insulation tester. All that is necessary is to set the change-over switch to "Meg," connect the terminals to the line and a good earth (or to the other wire if the test is between wires), turn the generator handle at about 160 r.p.m., and read the indication on the scale. In this measurement the position of the ratio switch is immaterial, as it is disconnected from the circuits. If the resistance under test should prove to be too low for accurate reading on the dial (or if the resistance of a conductor is to be determined), one can set the change-over switch to "bridge" without altering the external connections; and having adjusted the ratio switch to a suitable ratio, turn the generator handle, while adjusting the rheostat by means of the knobs, until the pointer is opposite the "infinity" mark on the dial. The speed of turning should be increased to at least 160 r.p.m., to ensure the maximum sensibility, before adjustment is finally concluded. The value of the resistance measured is then given by the figures seen through the windows alongside the adjusting knobs, multiplied or divided by the factor shown by the position of the ratio switch. To ensure the greatest accuracy the ohmmeter pointer should have its balance position truly at the "infinity" mark. If this is not the case, the wires should be disconnected from the terminals, the change-over switch set to "Meg," and while driving the generator at full speed, the screw marked "infinity adjuster" turned one way or the other until the pointer stands exactly on the "infinity" mark.

The wide utility of the "Bridge Meg" will be appreciated when it is realised that a continuous range of readings from 100 megohms down to 0.01 ohm are provided for. In both price and weight the new set represents about half those of the "Bridge-Megger." It weighs 12¼ lb., and its dimensions are 7 in. by 8¼ in. by 12 in.

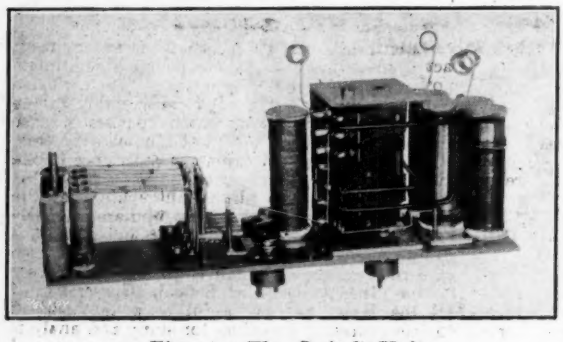


Fig. 4.—The Switch Unit.

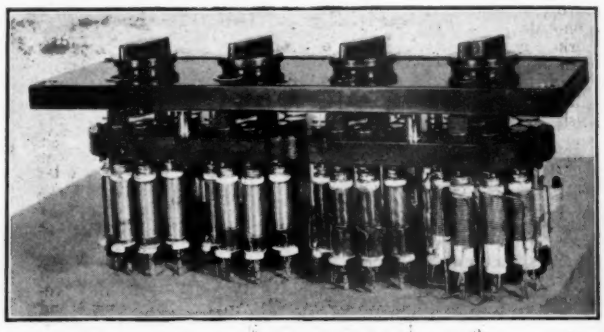


Fig. 5.—The Resistance Unit.

Reviews.

The Theory of the Gyroscopic Compass and its Deviations. By A. L. Rawlings, Ph.D., B.Sc.(Lond.). 6 in.×8¼ in. × ⅝ in. Pp. x+191; figs. 65. London: Macmillan & Co., Ltd. Price 10s. 6d. net.

The magnetic compass is associated in the mind of every electrical engineer with the first lessons he received at school in the science which was to form the basis of his profession in after life, and it is with something akin to regret that he learns that this interesting instrument upon which, he has been taught, the safety of the mariner upon the trackless ocean largely depends is gradually giving place to the more exact and the more dependable gyroscopic compass. In every warship in all the navies of the world, and in the majority of large ocean-going passenger liners, the gyroscopic compass is installed to guide the navigator on his way, and while there is still a magnetic compass for use as a stand-by in case the gyroscope fails, it is the latter instrument upon which the navigator normally depends, the master compass being installed below the main deck as nearly as possible to the centre of oscillation of the ship, a number of repeater cards operated electrically from the master card being installed at as many convenient situations, such as the bridge, the chart room, the captain's cabin, &c., as required. Moreover, the gyroscope itself is electrically driven by means of a small high-speed motor, and an elaborate system of protective devices ensures that this shall be kept running despite the failure of the main current supply, numerous indicating devices serving to show on the bridge the condition of affairs in the master compass room. Thus, the gyro-compass, to give it the name by which it is known to most navigating officers, is a device which concerns the electrical engineer very closely.

Unfortunately, the book before us does not attempt to deal with the operation, control, or protection of the electric motor driving the gyroscope at all, the author merely assuming for the purpose of his investigation of the theories governing the behaviour of his gyroscope that the necessary speed of rotation is maintained. Perhaps some of our readers are acquainted with the late Professor Perry's classical little treatise on "Spinning Tops;" if so, not only will they be to a large extent *au fait* with the theory of the gyroscopic compass, but they will recognise that it is a subject the complete understanding of which involves a considerable knowledge of higher mathematics. The author, however, draws an interesting analogy between the theory of alternating currents and that of the gyroscopic compass by recalling that, whereas a few years ago the former could only be understood by those possessing a knowledge of advanced mathematics, to-day the junior employé in an electrical undertaking who is a student at the evening classes of a technical school can readily discuss the theory of his work, so too it is possible greatly to simplify the mathematical expression of the theory of the gyroscopic compass. Hence, in the first part of this work the author endeavours to explain as simply as possible the theory underlying the operation of the gyroscope, and while we recognise a certain measure of simplification we find, for example, that he has still to employ differential equations of the second degree to cover the effects of angular momentum in three planes. Thence, having investigated his theories, he applies them to the three principal types of gyroscopic compass used at the present time, *viz.*, the Aushütz, the Sperry, and the Brown. In conclusion, he gives a survey of the errors to which these compasses are liable, together with the means provided to compensate for them. A valuable feature of the book is an appendix giving the report of the Phillpotts Committee set up by the British Admiralty to consider the development of the gyro-compass, in view of certain litigation which had taken place between the inventors of the different systems.

After a careful study of this book, upon which we desire to extend our congratulations to the author for the able manner in which he has done his work, we are still compelled to admit that the whole subject bristles with difficulties, both as regards its underlying theories and their practical application.

Electrification of Steam Railroads. By K. T. Healy. Pp. xiii+395; figs. 165. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

While it cannot be said that the technical aspects of railway electrification have reached or have even approached finality, 40 years of experience in electric train haulage has nevertheless resulted in the solution of a great variety of problems in connection therewith. As a consequence, the engineer can now guarantee the soundness of his design and equipment, but, where the need for electrification arises, the money necessary for its realisation remains a great difficulty. The economics of steam railway conversion are thus of first importance, and it is in this aspect rather than the technical one that the author deals. "Unfortunately," he says, "the general economic relationships in regard to electrification which assume such importance are extremely difficult to study and analyse. Economic generalisations are universally vitiated by the infinite variation of installation and operation conditions. In operation alone, the factors of traffic density, quality of service, operating methods, maintenance methods, roadway characteristics, motive-power characteristics, and labour, fuel, and material costs appear as major variants. The difficulty of economic deduction and generalisation is obvious. The study of these economic relationships must take the form of analysis of individual cases purely on their individual merits. This fails to supply the popular demand for sweeping statements as to economy based on results of previous

electrification, but any effort to cater for this demand is likely to cause misunderstanding. This leaves in the field of the economic relationships of electrification the study of the principles involved which are decidedly topics for discussion, and the indication of the dangers which are ever present in any analysis. Such discussion can be helpful in promoting thorough understanding of the problems and in making for a fair evaluation of expected results in individual cases." To this theme the author faithfully adheres, and the result is remarkably stimulating. The first three chapters deal with the general economics of electrification, source of power, and the basis of power contracts exactly along these lines. Subsequently the matter and treatment are of a more practical and operational type, concerned with sub-stations, distribution, and contact systems. Certain short sections of theory are interpolated here without adequate reason, since they give the chapters concerned an unwarranted "text-book" appearance. The two chapters on the overhead contact system are excellent, but the last part of the book, which deals with motors, control gear, drives, and locomotive mechanical details, is somewhat meagre by comparison. In fairness to the author, however, his remarks in the preface, regarding the emphasis laid on power, supply contracts, overhead distribution systems, and economic data as being those subjects not detailed in other works, should be noted. The book closes with a brief discussion of organisation and personnel for electric operation. The author is to be congratulated for an ordered and well-balanced contribution to the literature of the subject from a fresh and important standpoint.

Arc Welding.—The Lincoln Prize Papers, submitted to the American Society of Mechanical Engineers. Edited by EDWARD P. HULSE. Pp. ix+421; figs. 293. 1929. London: McGraw-Hill Publishing Co., Ltd. Price 25s. net.

The volume under review is a collection of the best papers submitted on arc welding in a competition for a prize fund of 17,000 dollars, given by the Lincoln Electric Co., of Cleveland, Ohio. The aim of this competition was to encourage improvement in the art of arc welding, the pointing out of new and wide applications of the process, and the indication of advantages and economies to be gained by its use. There were 77 papers submitted. The three prize papers and the two that received honourable mention, together with two others of outstanding merit, contained so much of value that it has been decided to publish them for the benefit of all those interested in the advancement and making practical use of the art of arc welding. The published papers cover the following aspects of the subject: fundamentals and economics, electric welding of ships' bulkheads and similar plated structures, theory and application of the base plate arc-welded rail joint, stable arc welding on long-distance pipe lines and duplicate steel structures, and as applied to construction work at the Philadelphia Navy Yard. The applications of arc-welding problems encountered in specific applications of arc welding to manufactured products are discussed, and the means and methods of solving these problems have also been set forth.

It is somewhat surprising that no reference is made by any of the authors of the papers to the researches of Strelow on the physical properties of the welding arc. Strelow has called attention to the difficulties of investigating what occurs in arc welding. The most accurate method was a photographic one, using an oscillograph to measure the current and voltage variations. The method indicated that, as the length of the arc changed, considerable alterations in the shape and in the amount of the material transferred occurred, and that the appearance of the arc altered with a change of polarity. It also indicated the effect of covering the iron electrode with other materials. Such investigations into the transfer of material, apart from their importance in welding, might throw further light on the nature of electricity.

Arc welding can be applied to a large range of work, from the small and light airplane joint to strength joints in the largest and most complex structure made of steel, such as a ship's hull. Practically all ferrous and non-ferrous metals can be welded by at least one of the arc-welding processes. Atomic welding and a combined arc- and gas-welding process are particularly suitable for the welding of alloy steels. Arc welding possesses many practical advantages over riveting, the most important of which are higher joint efficiencies, lightness, saving in weight, and elimination of noise. Arc welding has reached a state of scientific and practical development, which insures that reliable results can be obtained consistently. In support of this, the authors of the various papers offer a large amount of valuable evidence. Examples of joints having very high efficiencies in tensile, shear, bending, compression, shock, and alternating stress have been given, also of joints that were water- and oil-tight under severe test conditions. Savings in weight have been found to be as high as 71.4 per cent. The advance of welding has been handicapped by a lack of satisfactory design values for welds and simple methods of showing welds on drawings. These have been covered fully in an appendix to the prize-winning paper, and are used in the designs and illustrations submitted. As much of this information is used in the design departments and shops of a large U.S.A. industrial organisation and in the United States Navy, and tentatively approved by the American Welding Society, it can be used with confidence.

Much has been written on the application of the arc-welding process to ship-hull construction, but as a rule the writers have dealt in generalities, and have failed to give sufficient design information to enable the naval architect to attack the problem with confidence. Consequently, very little real progress has been made in the use of welding as a recognised method of jointing on the main structural or strength parts of ships. The third paper of this series deals with the subject of structural welding as applied to ships' bulkheads. The data and discussion are applicable also to plated structures.

In a short review it is impossible to give an idea of the wealth of information in these papers. It must suffice to say that the papers illustrate the rapid developments which are taking place in arc-welding operations, and that they constitute a valuable addition to the literature dealing with arc welding, and are the outcome of the long practical experience of the various authors. Much of the information is the result of original research carried out at some of the large American engineering works, railway workshops, and naval yards. A noticeable feature of the book is the exhaustive consideration given to many points of design and matters of detail. The mathematical treatment is of the simplest. Graphic methods are, where convenient, freely used, and figures illustrating the text are numerous.

The Profession of Engineering. A Collection of Essays, edited by D. C. JACKSON and W. P. JONES. Pp. ix+124. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

To-day, the first citizen of the United States is an engineer, and this is a fact of great significance and a source of legitimate satisfaction to other members of that profession. The inclusion of an essay from Mr. Hoover's pen adds considerably to the value and interest of this collection, which consists of nine essays, written by seven of America's most famous engineers, all of whom are men with long and extensive experience in one or more branches of the profession.

According to the preface, the editors anticipate that the book will be useful as a guide to young men who are considering the choice of a profession, and to parents and guardians who are advising young men in that position. It is also suggested by the editors, one of whom is Assistant Professor of English in the Speed Scientific School, University of Louisville, that the book may be useful as a textbook in engineering English courses "providing for study and analysis examples of the writing of several prominent engineers." For this purpose, we should have thought, more useful matter might have been found elsewhere, for, although the style of these essays is on the whole quite good, it does not reach an exceptionally high standard.

The first essay, by Mr. D. W. Mead, deals with the engineer and his education, and begins by considering the functions of the engineer and his relations with men in other walks of life. The wealth of opportunity which the profession offers, and the high qualities which an engineer must possess, if he is to achieve permanent success, are fully set out in this essay. The ambitious young man will be attracted by the former, and, according to his disposition, he will be stimulated or discouraged by the latter, while the established engineer who peruses these essays may catch himself falling, unawares, into the mental attitude of "little Jack Horner." It is interesting to find architecture classed as a branch of engineering.

Mr. Mead rightly stresses the importance of the social relationships into which an engineer must enter, relationships with employers and employés, with customers and contractors, and he puts personality in the forefront amongst the factors which make for success. Many employers, who have sought in vain for men for the higher positions on their staffs, would agree with Mr. Mead when he says: "The positions of great responsibility, however, usually involve so great a degree of personal devotion and the sacrifice of so many of those personal pleasures of life that demand a large amount of time and energy in their enjoyment, that there are few who are willing to pay the price of the greatest professional success." Another faculty which, Mr. Mead insists, is essential in a successful engineer, is the power to express himself clearly and convincingly in speech and in writing, and in a second essay by the same writer these themes are developed further.

In an essay on Civil Engineering, Mr. G. F. Swain says that the training of an engineer must be essentially a training for service, a training which makes for honesty and which, "if combined with business ability, makes the very best administrators." In discussing methods of training engineers, he points out that different methods suit different temperaments, and he says that some men "learn better when, from day to day in their actual work, they see the necessity for learning," while some men "would become indifferent or lazy in a college atmosphere." He speaks well of sandwich and similar systems of training, and says that they are valuable because a student thereby learns that "the entire value of what is learnt depends on ability to use it." In the reviewer's opinion the value of a period of works training, interpolated into a college course which has followed directly on a school career, lies in the quickened zest and interest with which the student returns to his theoretical studies. Whilst in the works, on the one hand, he sees many things which he wishes to understand and, on the other, he is spurred on to acquire that power which he sees other men applying by virtue of knowledge they possess. When he goes back to his college he studies with a definite, steadying purpose in his mind, and this carries him along further, and makes his progress more rapid than any stimulus which his tutors could otherwise apply.

The remaining essays deal in a similar manner with the scope and character of an engineer's training, life and work in Mechanical, Electrical, and Mining Engineering.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

An Automatic Scaling Machine for Electric Welding.

The Westminster Engineering Co., Ltd., Victoria Road, Willesden Junction, N.W.10, has recently introduced an automatic scaling machine, fig. 1, for removing the scale from the edges of steel plates before contact welding, which, it is believed, has revolutionised the cost of electric welding by the contact process, as it enables a cheap grade of steel to be used. The process is very quick, as the machine removes the scale from all four surfaces of two edges of a steel plate simultaneously at a high rate of speed. As an instance, a drum body 36 in. long has all four surfaces scaled in 15 seconds. The plates are loaded and the edges securely clamped to an electrically-driven trolley which carries the edges past the grinding

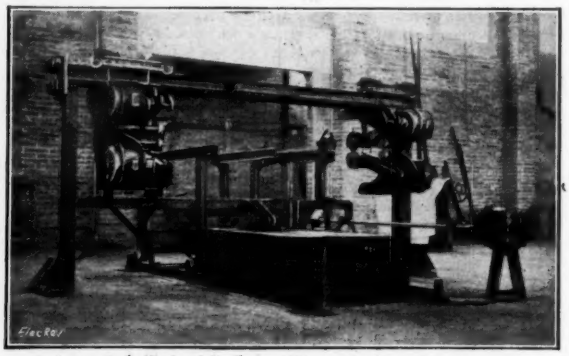


Fig. 1.—"Westminster" Automatic Scaling Machine.

wheels. This trolley automatically returns to its original position, so that the sheets can be loaded on one side and delivered on the other side of the machine, and all four surfaces to a distance of approximately ½ in. can be scaled and ready for seam welding without any further preparation. The grinding wheels of special material are floating, spring suspended, and electrically driven, the arrangement being fully covered by patents both at home and abroad. The standard size of machine deals with plates 75 in. by 40 in., and is quickly adjustable for any smaller dimensions. The machines have been severely tried in actual practice, and in one factory alone over a third of a million 40-gallon drum-bodies were scaled and subsequently seam welded in nine months. The scaled surface is such that, when welded in the makers' automatic seam-welding machine, the body seams will stand corrugating, and subsequently will pass an air-prssure test.

An Electrically-heated Foster-Mother.

The "Inventum" electrically heated foster-mother, fig. 2, which is marketed by Mr. Alan Wright, 117, Victoria Street, S.W.1, is constructed with an outer casing of heavy-gauge galvanised-iron, and is of robust construction. The element is totally enclosed and of large dimensions in relation to its electrical loading, so that the surface temperature is not too high. The heating wire is embedded in heat-accumulating

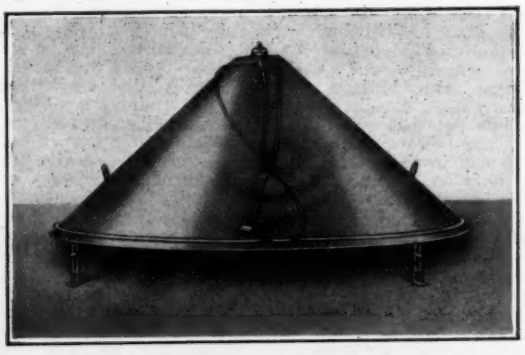


Fig. 2.—"Inventum" Foster-Mother.

material, and once this is thoroughly heated, the three-heat switch can be turned to "medium" or "low," to make up radiation losses and maintain an equable temperature in the foster-mother. The feet are adjustable from a minimum of 4 in. to a maximum of 6 in. The cost of running is approximately 0.5 kWh per chick for the period during which the foster-mother is required. The appliance is readily portable. Handles are not supplied unless specially ordered, due to the fact that the chickens sometimes roost upon them. There is no extra charge for handles. The apparatus is made in two sizes for 150 and 400 chicks. The loadings in watts for maximum, medium and low are, respectively, 400, 250, and 150, and 700, 450, and 250.

A Novel Fluid Meter.

Under the above heading in our issue of March 15th, 1929, we published particulars of the "Fluidmeter" introduced by Messrs. Fluidmeters, Ltd., Winchester House, Victoria Square, Birmingham. We are now interested to learn that H.M. Board of Trade Weights and Measures Department, after very drastic tests, has approved and certified "Fluidmeters" for bulk storage as being within the prescribed limit of accuracy, and therefore much more reliable and satisfactory than the antiquated dip stick, which is neither approved by the Board of Trade nor upheld in courts of law.

New Lighting Reflectors.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham, are about to introduce some new ranges of dispersive and intensive-type reflectors for all commercial, industrial, and street-lighting purposes, fig. 3. They have been specially designed to reduce labour charges to a minimum. Bolts, nuts, &c., have been entirely eliminated, and the number of components is virtually two only—body and top. The body is a steel spinning, vitreous enamelled—outside silver-grey, inside pure white. The rim is turned downwards and inwards, so as to prevent the lodgment of moisture. Cast-iron is replaced by a special alloy of great strength, but of extreme lightness. The design of the top varies with the size, but in principle it is unaltered. It consists of a carrier with lugs, engaging with slots or holes in the neck of the body, and thus supporting it.

Fig. 3.—A New "Simplex" Reflector.

When the crown plate is screwed down, the body and top are secured firmly together. Bosses on the underside of the crown plate automatically ensure ventilation. When fixing, the crown plate is slackened, so that the carrier lugs may drop clear of the slots or holes. By turning the top slightly it may be lifted clear of the body, which can be left out of the way until it is needed. The top is then firmly screwed on to the down run of the conduit, and connections made in the usual way. The body is then easily slipped into position, so that it is properly supported by the carrier, and the crown plate screwed down, when the reflector is ready for service. These new reflectors fully comply, it is claimed, with all Home Office recommendations, and exhaustive tests have been successfully carried out by the National Physical Laboratory.

Improved Hack-Saw Blades.

We have received from Messrs. Fry's (London), Ltd., 24-26, Water Lane, E.C.4, samples of their new process "Enox-S.T." hack-saw blades. The makers claim that the new blades, which have been produced as the result of some years of research work, are not only "unbreakable," but will average 20 per cent. more cuts than ordinary hack saws. The following is abstracted from the makers' letter:—"We despatched a sample parcel of blades at the request of the India Office to an Indian railway. The test of these blades was that they should each cut 12 pieces of 0.65 carbon steel. Each blade was worked to a finish, and the average cuts per blade was 70, or nearly six times as much as was expected."

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Synchronous Motors.

I very much fear that "Non-Mathematician" will not find in the explanations of your correspondents, in this week's issue, the plain answer which he requires to his question regarding synchronous motors. With your permission therefore, I should like to submit the following.

A synchronous motor is an alternator, and to be connected to a source of a.c. supply its internal e.m.f. must be in phase opposition, *i.e.* it must have a displacement of 180 degrees from the supply pressure.

With a certain value of field excitation the internal e.m.f. will equal the supply e.m.f. and no current will flow.

With a stronger field there arises an excess of pressure in phase with the internal e.m.f. and a current will flow, and, owing to the high inductance of the armature winding, this current will lag by 90 deg., if we ignore the comparatively small resistance. (Observe that 90 deg. lag from the internal e.m.f. equals one half its displacement from the supply e.m.f.; therefore the current will *lead* the supply e.m.f. by 90 deg.)

With a weaker field the excess of pressure is in phase with the supply, and a current flows which *lags* 90 deg. behind the supply pressure.

In one case, then, we have a leading current, and in the other a lagging current, which, combining with the load current, will modify the power factor accordingly.

Nothing was asked about the loa dcurrent, and therefore nothing has been said, as this only tends to confuse the issue, which, as will be seen, is quite a simple one when cleared of all irrelevant matter.

As to the book suggested by "Non-Mathematician," he may be interested to know that the present writer's own book, "Rotary and Motor Convertors," has a chapter devoted to the subject of alternators in parallel, both as generators and motors, in which the matter is dealt with entirely without mathematics (as is the whole book), although vector, or rather "clock," diagrams are used as pictures of the relationships existing in different circumstances.

Ernest F. Smith.

Dunfermline, *August 26th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

3,506. "Means for, and methods of, improving the power-transmitting capacity of super-tension alternating-current systems of electrical power transmission." A. M. Taylor. February 4th, 1928. (Cognate applications, 5,999/28, 9,011/28, 10,464/28, 25,812/28, and 30,456/28.) (Addition to 264,196.) (317,099.)

10,086. "Wiring arrangement for electrical apparatus." Igranic Electric Co., Ltd., J. H. Reyner, and A. H. Curtis. April 3rd, 1928. (316,903.)

10,373. "Inductance coils for ranges of different wave-lengths in wireless-telegraphy and telephony." G. R. Lamm. April 5th, 1928. (316,958.)

11,935. "Sound-reproducing or transmitting instruments." W. R. Westhead. January 7th, 1929. (317,134.)

12,051. "Driving system for induction-measuring instruments." Landis and Gyr Soc. Anon. September 9th, 1927. (296,771.)

12,709. "Electrical conductors." H. A. Whitehorn (Bell Telephone Laboratories, Inc. (in part). April 30th, 1928. (Cognate application, 6,316/29.) (316,908.)

12,790. "Plug-and-socket and like electrical connections particularly for panels of wireless apparatus." Paragon Rubber Manufacturing Co., Ltd., and G. W. Croot. May 1st, 1928. (Addition to 267,172.) (316,909.)

12,933. "Diaphragms, more particularly for loud-speakers and the like." Siemens & Halske Akt Ges. May 6th, 1927. (Addition to 287,065.) (289,887.)

13,036. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker, and E. P. G. Wright. May 3rd, 1928. (316,912.)

13,078. "Audible warning and signalling devices." F. G. Bell. May 3rd, 1928. (316,915.)

13,264. "Combined switch and condenser for wireless aerials." R. N. Wellington. May 5th, 1928. (316,921.)

13,296. "Electric ignition apparatus for incandescent gas burners." South Metropolitan Gas Co. and J. H. Smith. May 5th, 1928. (316,923.)

13,633. "Apparatus for electrically exploring the ground or soil." Dr. R. Ambronn. May 24th, 1927. (291,025.)

13,781. "Automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., E. P. G. Wright, J. H. E. Baker, and A. H. Cameron. May 10th, 1928. (317,120.)

13,935. "Electric cables." Weitverkehrskabel Ges May 11th, 1927. (290,257.)

14,040. "Transmitters for use in wireless signalling." E. Binard. May 12th, 1927. (290,303.)

14,055. "Secondary electric batteries. V. Herold. May 12th, 1928. (317,130.)

14,282. "Electrolytic deposition of chromium." C. H. R. Gower and S. O'Brien & Partners, Ltd. May 15th, 1928. (317,137.)

14,311. "Television or like systems and apparatus." J. L. Baird and Television, Ltd. May 15th, 1928. (317,143.)

14,752. "Electromagnetic devices." Siemens Bros. & Co., Ltd., F. Baker, and E. R. Garrod. May 19th, 1928. (317,149.)

15,252. "Electrical indicators." India Rubber, Gutta Percha and Telegraph Works Co., Ltd., and W. G. Spinks. May 24th, 1928. (317,151.)

15,459. "Electric gas-discharge rectifiers." M.-O. Valve Co., Ltd., and J. W. Ryde. May 25th, 1928. (317,153.)

15,893. "Internal-combustion engine electric generator power units." Associated Electrical Industries, Ltd. May 31st, 1927. (291,383.)

16,170. "Power-factor control for electric power-distribution systems employing motor generators." S. Melton. June 2nd, 1928. (317,160.)

16,809. "Electric switches." W. Holmes and Ferranti, Ltd. June 9th, 1928. (317,167.)

16,947. "Field magnets for microphones, loud-speakers, and the like." F. W. Lanchester. June 12th, 1928. (317,169.)

17,758. "Transmitters for radio-telephony." Igranic Electric Co., Ltd., and D. Sinclair. June 19th, 1928. (317,174.)

17,962. "Sunk switches as used in electric wiring systems." A. Preston. June 21st, 1928. (317,175.)

18,125. "Electron-discharge devices." British Thomson-Houston Co., Ltd. June 22nd, 1927. (292,563.)

18,135. "Starting arrangements for electric discharge devices." H. Busse. June 22nd, 1928. (317,178.)

18,338. "Sound reproducers." Brandes, Ltd. July 30th, 1927. (294,874.)

18,610. "Electric circuit-controlling apparatus." H. Panzetta. June 27th, 1928. (317,186.)

18,724. "Loud-speaker system." W. Kunze and Radiofrequenz Ges. July 30th, 1927. (294,877.)

19,559. "Fluid-actuated relays." F. E. Bancroft and Associated Electrical Industries, Ltd. July 5th, 1928. (317,192.)

20,220. "Vents for electric battery cells. National Carbon Co., Inc. July 23rd, 1927. (294,476.)

20,582. "Electric coupling devices." General Electric Co., Ltd., and H. W. Cron. July 16th, 1928. (317,201.)

20,619. "Electricity meters combined with time-measuring devices." G. Wall and Associated Electrical Industries, Ltd. July 16th, 1928. (317,202.)

20,856. "Electric switches." S. H. Munro and D. E. C. Foster (trading as W. White & Co.). July 18th, 1928. (317,203.)

21,557. "Manufacture of photo-electric cells." General Electric Co., Ltd., and N. R. Campbell. July 25th, 1928. (317,209.)

21,823. "Mechanism for producing step-by-step movements, particularly applicable to the switches of electrical control systems." Forges et Ateliers de Constructions Electriques de Jeumont. November 19th, 1927. (300,895.)

22,168. "Aerials for wireless receivers." D. Montague and S. Montague. July 31st, 1928. (317,215.)

22,380. "Screening wireless receiving apparatus." C. Farrar. August 2nd, 1928. (317,217.)

22,601. "Acoustic devices such as loud-speaking telephones." Electrical Research Products, Inc. August 17th, 1927. (295,686.)

22,754. "Methods of reducing the intensity of unduly intense impulses in electrical amplifiers or loud-speaker circuits." A. F. Pollock and D. A. Pollock. August 7th, 1928. (317,221.)

22,755. "Loud-speakers." A. F. Pollock and D. A. Pollock. August 7th, 1928. (317,222.)

23,208. "Arrangements for measuring electrical quantities." Siemens Bros. and Co., Ltd., and A. Rosen. August 11th, 1928. (317,226.)

23,717. "Therapeutical lamps." A. K. Croad (Hanovia Chemical and Manufacturing Co.). August 17th, 1928. (317,231.)

23,754. "Process for testing and starting the working of high-tension lines." Siemens-Schuckertwerke Akt. Ges. September 29th, 1927. (297,819.)

24,162. "Electric circuit controllers." British Thomson-Houston Co., Ltd. August 24th, 1927. (296,058.)

24,429. "Insulation of electric cables." W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath. August 24th, 1928. (317,237.)

24,750. "Electric heating elements." Automatic Telephone Manufacturing Co., Ltd., and C. H. Archer. August 28th, 1928. (317,239.)

24,922. "Support for the electrode systems of electronic valves." Loewe-Audion Ges. and Dr. E. Roemhild. August 31st, 1927. (296,410.)

24,944. "Electric condensers." British Thomson-Houston Co., Ltd. September 2nd, 1927. (296,447.)

25,376. "Radio and the like high-frequency circuits." Marconi's Wireless Telegraph Co., Ltd. September 3rd, 1927. (296,677.)

25,875. "Sound-reproducing apparatus." British Thomson-Houston Co., Ltd. May 19th, 1928. (312,031.)

26,931. "Vehicle headlights." J. A. Gray. October 17th, 1928. (317,250.)

27,330. "Thermally-responsive systems in or for electrical apparatus." Associated Electrical Industries, Ltd. September 30th, 1927. (297,834.)

29,594. "Means for driving machines by two mechanically-coupled asynchronous polyphase motors." Siemens-Schuckertwerke Akt. Ges. October 15th, 1927. (298,901.)

30,044. "Thermionic valve transmitters for use in radio and other high-frequency systems." Telefunken Ges. für Drahtlose Telegraphie. October 17th, 1927. (298,959.)

30,817. "Sparking plug for internal-combustion engines." L. Korczynski. October 24th, 1928. (317,260.)

30,839. "Electrolytic extraction of metals." Soc. Anon. le Nickel. April 13th, 1927. (Divided application on 288,605.) (299,375.)

32,099. "Depolarising plate for galvanic cells." Siemens & Halske Akt. Ges. November 17th, 1927. (300,640.)

34,063. "Electromedical apparatus." Siemens-Reiniger-Veifa Ges. für Medizinische Technik. June 13th, 1928. (313,512.)

34,217. "Control systems for elevators, hoists, and the like." Associated Electrical Industries Ltd. November 23rd, 1927. (301,030.)

34,417. "Visual signalling systems." E. Shipton. November 22nd, 1928. (317,271.)

35,371. "Telephone systems." Siemens & Halske Akt. Ges. December 9th, 1927. (301,008.)

37,661. "Electric starters for internal-combustion engines." Scintilla Akt. Ges. March 15th, 1928. (307,876.)

1929.

277. "Method of manufacturing storage battery plates and the product thereof." Furukawa Denki Kogyo Kabushiki Kaisha. January 17th, 1928. (304,231.)

1,537. "Continuous windings for electrical apparatus such as transformers." British Thomson-Houston Co., Ltd. January 21st, 1928. (Addition to 282,730.) (304,592.)

2,875. "Electric motors for driving spinning cans and the like." F. Newton. June 13th, 1928. (Divided application on 307,523.) (317,291.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 28th:—

Mellowave. No. 501,949. Class 8. Electrical pick-ups, &c., for talking and like machines.—W. E. Martin, 17, Claremont Road, Hockley, Birmingham.

S.O.S., Soul O'Sound (lettering and design). No. 503,458. Class 8. Radio-telephonic apparatus and parts thereof, &c.—Wembley Scientific Laboratories. Ltd., Elite Works, Raglan Gardens, Wembley, N.W.

Telehor. No. 504,647. Class 8. Radio-telephonic apparatus and parts thereof, &c.—Andrew Berger, 10, Holdershill Avenue, Hendon, N.W.

"G" (lettering and design). No. 503,526. Class 13. Electric incandescent lamps (ordinary).—Gustav Ganz & Co., Vienna. (British representatives: Lloyd, Wise & Co., 10, New Court, Lincoln's Inn, W.C.2.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERLADY.—School, for East Lothian Education Authority; Morhan & Brotchie, surveyors, 29, Hanover Street, Edinburgh.

AYR.—Extensions, public library, with hall to seat 400, for the T.C.; burgh surveyor.

BEBINGTON.—Elementary school, Stanton Road (£26,764); Cheshire Education Committee.

BERWICK-ON-TWEED.—Re-erection of premises, Walkergate, electrically equipped, for Messrs. Ayton (£6,000 to £7,000).

BIRMINGHAM.—Reconstruction of Wesleyan mission hall, Nechells Park Road; Rev. E. B. Perkins, Central Hall, Corporation Street.

BLOFIELD.—Housing scheme, Burlingham estate, for the R.D.C.

BRAINTREE.—Post office and telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W. (returnable deposit of £1 1s.).

BRIGHTON.—Eye hospital, Queen's Road, for T.C. (£25,000).

BURTON-ON-TRENT.—Labour exchange, for H.M. Office of Works, King Charles Street, London, S.W.

BURY ST. EDMUNDS.—Girls' senior school (£9,400), for the borough E.C.; Naish & Mitchell, architects.

CAMBRIDGE.—Extensions, Peckover nurses' home (£10,616), for Addenbrooke's Hospital Governors; Henry Martin, builder.

CANNOCK.—Library, for the U.D.C.; Council's architect.

CARLISLE.—Re-erection of saw mill, Byron Street, Caldewgate, for J. & R. Creighton, Ltd.

CHARD.—Infirmary block, for the Board of Guardians; Mr. Foster, builder.

CHEADLE.—Adaptation of premises, High Street, as motor garage; J. Wrest, engineer and surveyor, Council offices.

CHICHESTER.—Domestic subjects centre, for West Sussex E.C.; county architect, Chichester.

CHORLEY.—Additions, corn mill, Lyons Lane; W. Hoole. Hospital, Preston Road; hospital governors.

COLESHILL.—Remodelling secondary school; Warwickshire Education Committee.

COLNBROOK.—Re-erection of portion of mills, Poyle, for Ralph Alcock & Sons.

CREWE.—Labour exchange, for H.M. Office of Works, King Charles Street, London, S.W.

DARTFORD.—Post office, for H.M. Office of Works; J. W. Ellingham, builder.

DEAL.—Extensions, War Memorial Hospital, with nurses' home (£10,000); secretary.

DUNSTABLE.—Buildings, Whipslade estate, for the Zoological Society; T. A. Kingerlee & Sons, builders, Oxford.

EAST DEREHAM.—Extensions, elementary school; Norfolk Education Committee.

ELLESMERE PORT.—Modern school (£16,715); Cheshire Education Committee. Paper mills; W. V. Bowater and Sons, Ltd., 121, Queen Victoria Street, London, E.C.

GLASGOW.—26 shops, Dumbarton Road and Victoria Drive, Scotstoun; W. Taylor, builder, 2107, Paisley Road. Baths, Wolesey Street (£34,000); libraries, Gorbals and Pollokshaws districts (£45,000); city engineer.

GRAYLINGWELL.—Extensions, mental hospital, including blocks for 165 women, admission hospital, and nurses' home, for West Sussex C.C.; clerk, Chichester.

HALVERGATE.—Junior block, elementary school; Norfolk Education Committee.

HERNE BAY.—Pier entrance (£7,500); U.D.C. surveyor.

HILGAY.—Housing scheme; Downham R.D.C.

JOHANNESBURG. — Buildings, for trade exhibition (£300,000); Union Government.

LEICESTER.—Police station (£80,000), for the T.C.; borough engineer.

LITTLE PLUMSTED.—Extensions, mental hospital (£80,000); Norfolk county architect and Board of Control.

LONDON (Chelsea, S.W.).—Development, central portion of Sloane Square; borough engineer and Sir Reginald Blomfield. Dwellings, Manor Street; Peabody Donation Fund trustees. Flats and garages, Bedford Terrace; C. H. Roberts. Shops and flats, King's Road; Hammond & Barr, Ltd. Further block of dwellings, World's End area; Chelsea Housing Improvement Society, Ltd.

(Westminster, S.W.).—Extensions, County Hall (£660,000); Ernest Stone Collins, architect, 29, Copers Cope Road, Beckenham.

(Soho, W.C.).—Theatre (£250,000), Shaftesbury Avenue; Bertie Crewe, architect, 4, New Compton Street.

LONGRIDDY.—School, for East Lothian Education Authority; Morhan & Brotchie, surveyors, 29, Hanover Street, Edinburgh.

MANCHESTER.—Burnage Municipal high school; director of education, Education Offices, Deansgate.

MOUNTAIN ASH.—School (£11,806), for the E.C.; clerk.

NORTHERN IRELAND (Belfast).—Dock (£376,000); secretary to the Belfast Harbour Board.

NORWICH.—Extensions, County Offices, Thorpe Road site; Bardman & Sons, architects for Norfolk County Council.

PERTH.—Art gallery; burgh surveyor.

PONTEFRACT.—Additional 72 houses, for the R.D.C.; surveyor.

RHYL.—School, for Flints. E.C.; R. G. Whitley, county architect, Mold (returnable deposit of £5).

RICKMANSWORTH—Housing scheme (58), for the U.D.C.; surveyor.

ST. HELENS (Lancs.).—School (400 places), for the borough E.C.; W. H. Andrew, clerk.

SALE.—Extensions, County High School for Girls; F. A. Browne, county architect, Newgate Street, Chester (returnable deposit of £2 2s.).

SCUNTHORPE.—Addition of practical workrooms to Doncaster Road school; Scorer, Gamble & Co., architects, Bank Street Chambers, Lincoln (returnable deposit £2 2s.).

SHEERNESS.—Central school for girls, for the Kent E.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

SIDCUP.—County school for girls, for Kent E.C.; W. H. Robinson, architect, Springfield, Maidstone (returnable deposit of £2 2s.).

SOUTHAMPTON.—Extensions, hall of residence, for the University College Council; Gutteridge & Gutteridge, architects, 9, Portland Place (returnable deposit of £2 2s.).

STIVICHALL.—Development, Hall estate; J. G. Gray, Coventry.

TERRINGTON.—Central and junior schools (£10,000); Norfolk Education Committee.

THETFORD.—Extensions, boys' grammar school (£8,650); tion of Cornwall; Cowell, Drewitt & Wheatly, architects, Mansion House (returnable deposit of £2 2s.).

TORQUAY.—Additions, Queen's Hotel, Victoria Parade; F. P. Harrison. Swimming bath (£11,800); H. A. Garrett, borough engineer.

TREDEGAR.—Church, Dukestown; W. Edgar Jones, architect. Business stores, Commercial Street, for F. W. Woolworth & Co., Ltd., bazaar proprietors, Kingsway, London.

TRURO.—Extensions, county museum, for the Royal Institu- governors.

TUNSTALL.—Housing scheme, Little Chell Lane; Stoke city engineer.

WATTON.—Junior school; Norfolk Education Committee.

WESTON.—Mental colony; A. C. Bunch, Warwickshire county architect.

WREXHAM.—Extension of War Memorial Hospital and reconstruction of nurses' home; hon. secretary.